

Dimensioning



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- Dimensioning components & their recommended practices
- Dimensioning the object' s features
- Placement of dimensions.
- Problem solving steps



Introduction

Definition

- **Dimensioning** is the process of specifying part's information by using of lines, number, symbols and notes.
-

Notes

1. Lines to be used are always **thin continuous** line.
2. Symbol or abbreviation commonly found in a drawing are
 - “**diameter**” is represented by a symbol “ ϕ ”.
 - “**radius**” is represented by a letter “**R**”.

Types of an information

- A **basic** information (this **course**)
 1. **Sizes** and **location** of the object's features. (this **chapter**)
 2. Type of material
 3. Number of piece required to assemble into a ~~single unit~~

- A **higher-level** information of a product (or machine).
 1. Tolerances : Size and geometric
 2. Surface roughness
 3. Manufacturing or assemble process descriptions.

Example : Roughness condition

			0.4	16
			0.8	32
			1.6	63
			3.2	125
			6.3	250
			12.5	500
HORIZONTAL MILLING	VERTICAL MILLING	TURNING	μm Ra	μ'' AA
Process			Level	



Dimensioning components :

General topics

Dimensioning components

■ Extension lines

- indicate the location on the object's features that are dimensioned.

■ Dimension lines (with arrowheads)

- indicate the direction and extent of a dimension, and inscribe

■ Dimension numbers

(or dimension figures)

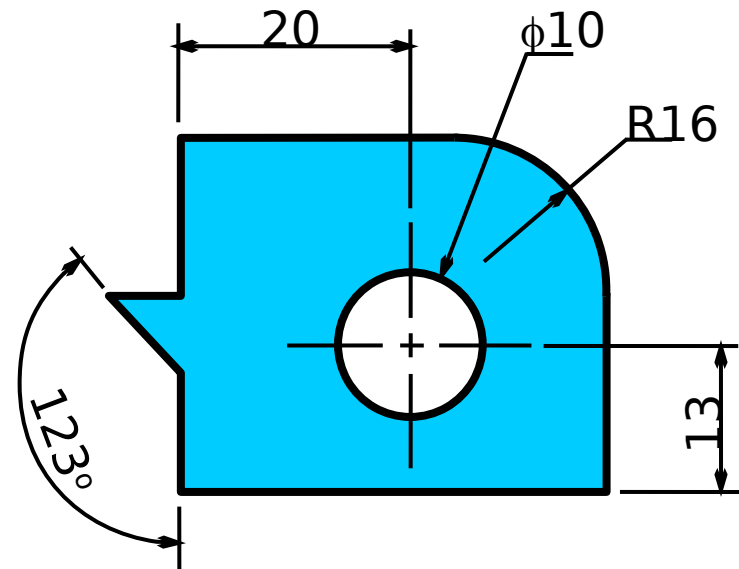
■ Leader lines

- indicate details of the feature

■ Notes with a *local* note.

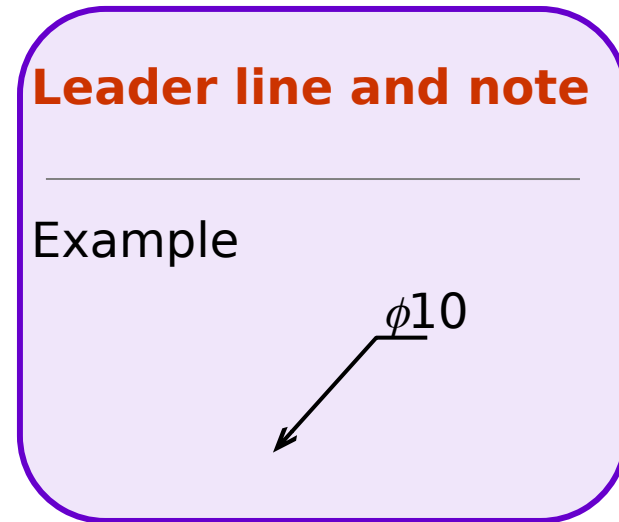
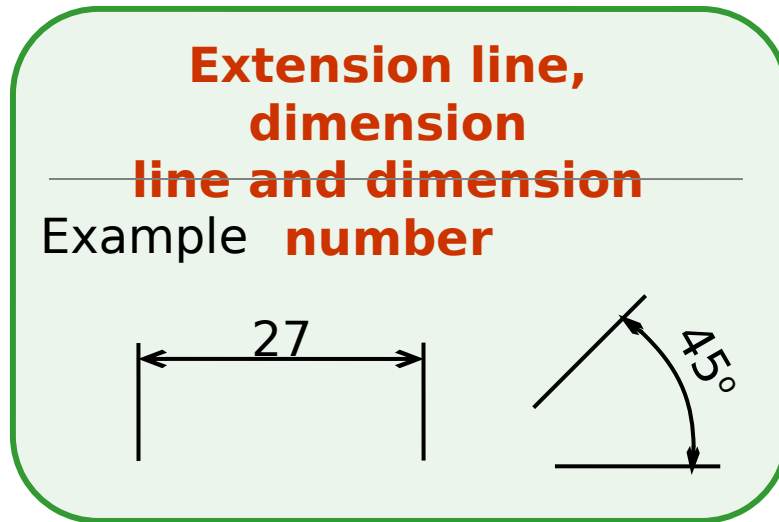
- local or general note

Example



Applying the dimensioning components

- Mostly done by using



Notes

- The appropriate method depends on the object's features.
- Detail of a local note depends on the object's features.



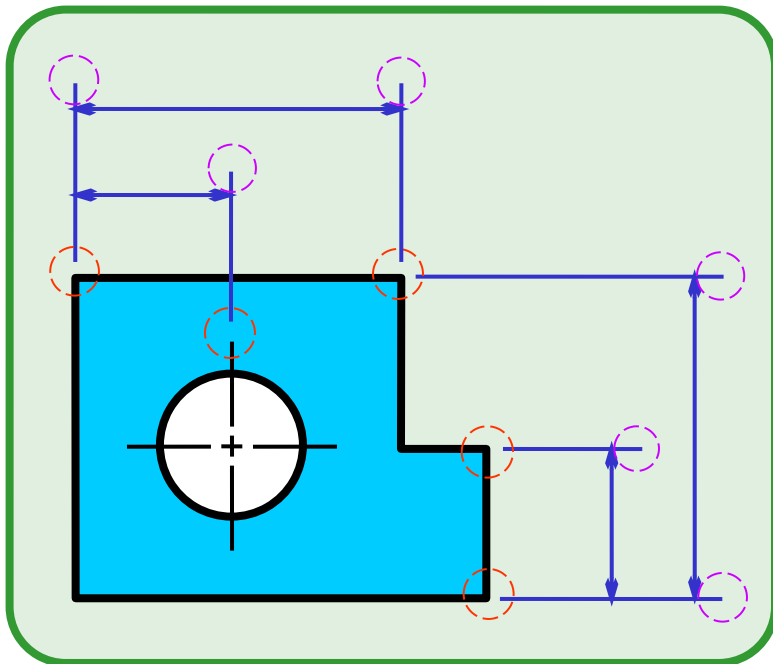
Dimensioning components :

Recommended practice

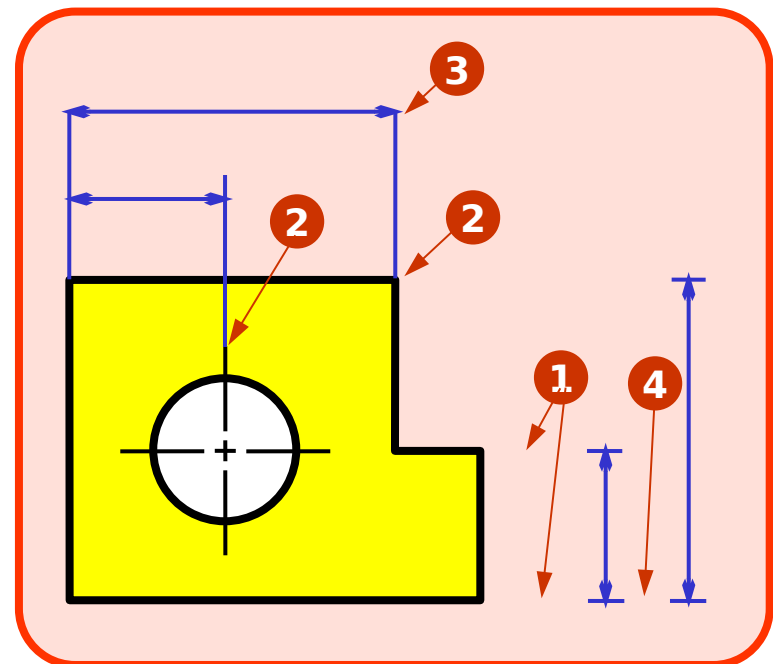
Extension line

- Always leave a **visible gap** (≈ 1 mm) from a view or center lines before start drawing a line.
 - Extend the lines **beyond** the (last) dimension line 2-3 mm.
-

Good practice



Poor practice



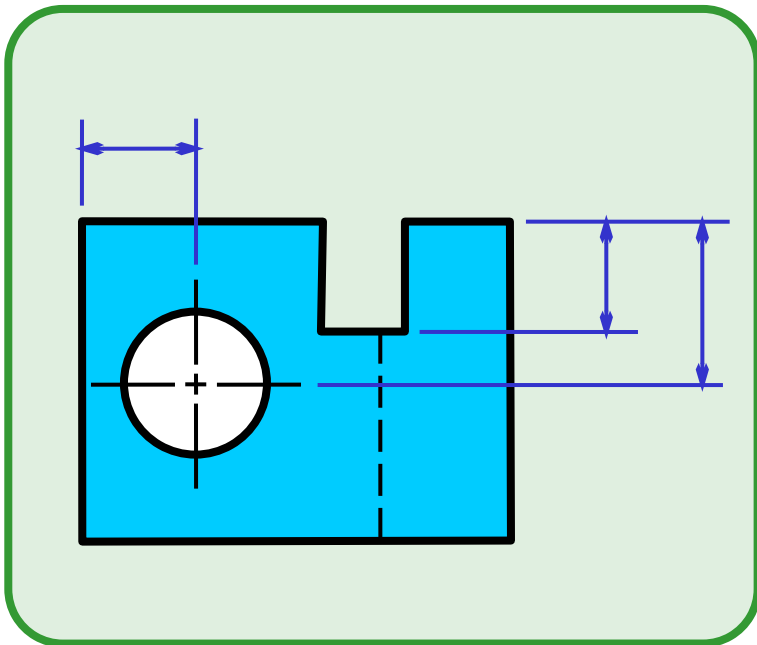
Extension line

- **Do not** break the extension lines as they cross any line

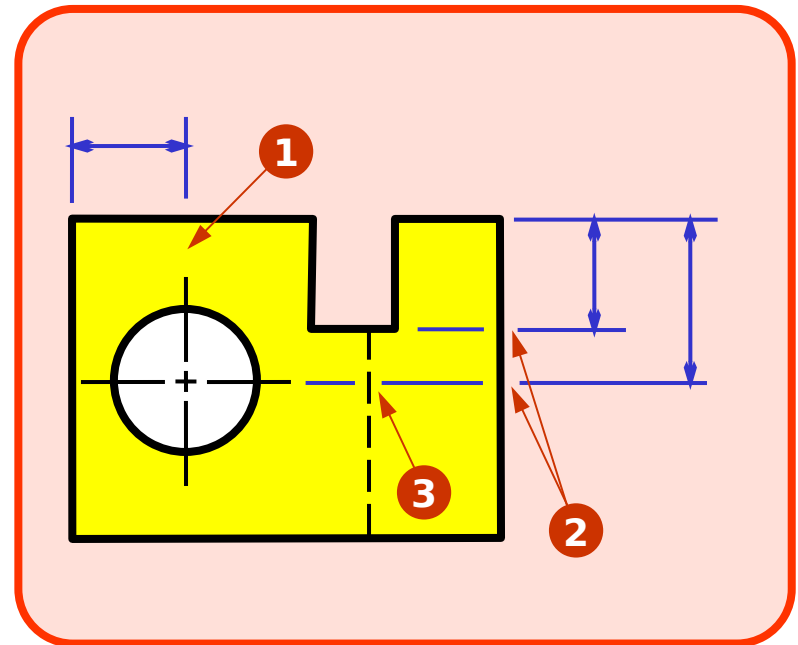
types, e.g. visible line, hidden line or center line,

i.e. extension line **always a continuous line**

Good practice



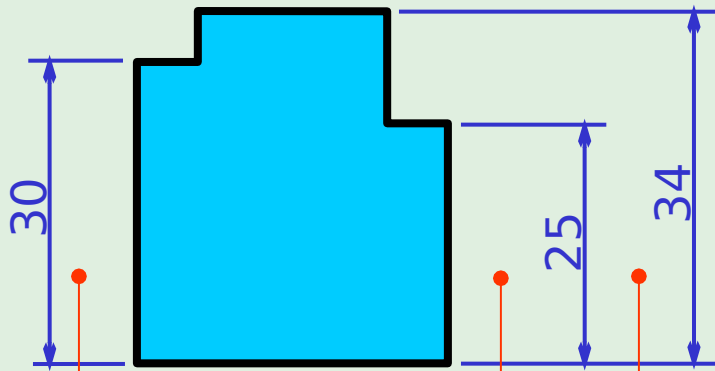
Poor practice



Dimension line

- Dimension lines should be appropriately spaced apart from each other and the view.

Good practice

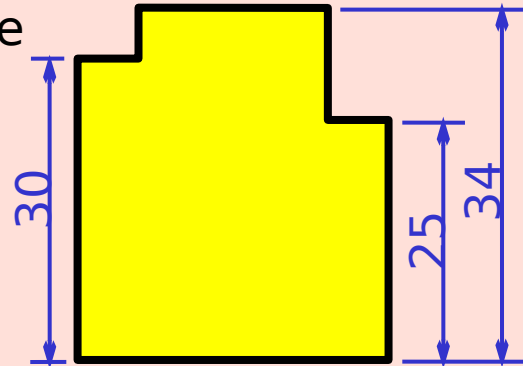


At least 2 times
of a font size

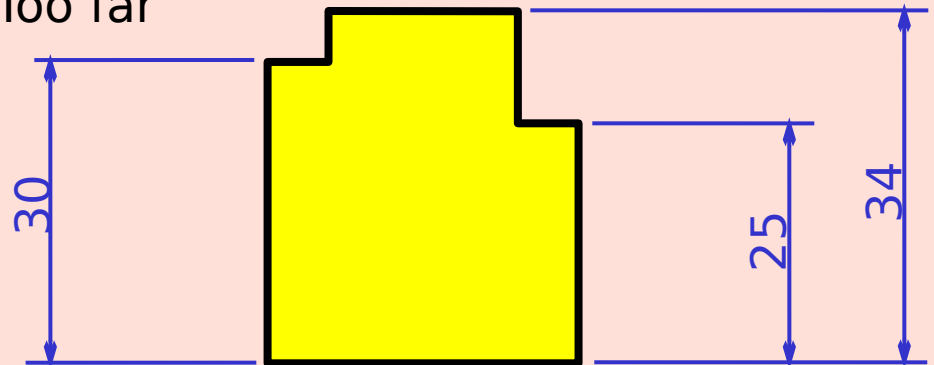
At least 1 time
of a font size

Poor practice

Too close



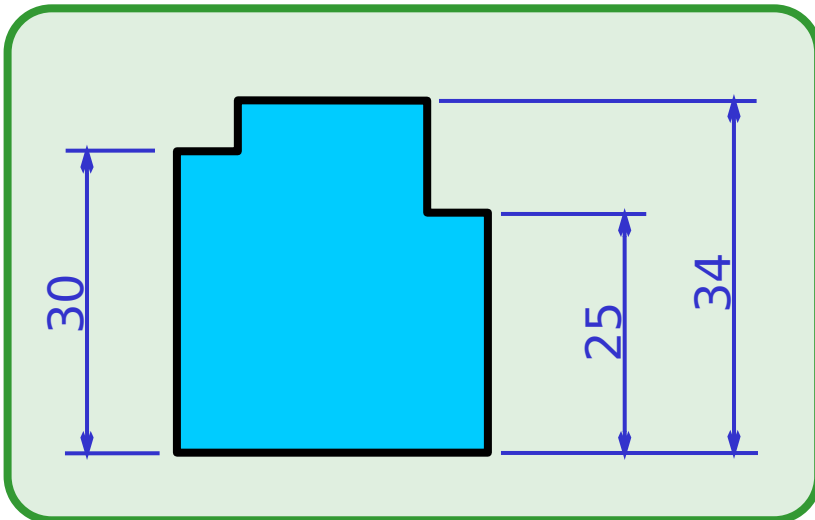
Too far



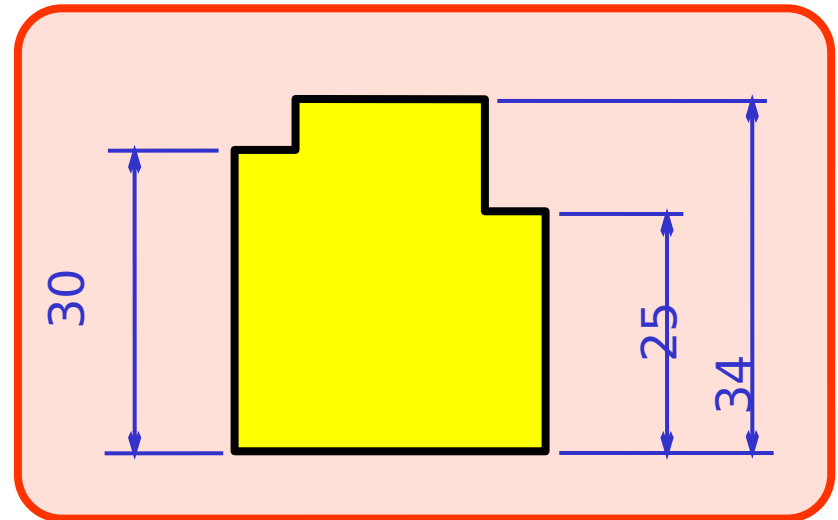
Dimension number : General

- Lettered with **2H** or **HB** pencil.
 - The height of numbers is suggested to be 2.5~3 mm.
 - Place the numbers at about 1 mm *above* and *at a middle* of a dimension line.
-

Good practice



Poor practice



Dimension number : Number system

1. Metric system (This course)

(ISO and JIS standards etc.)

Examples 32, 32.5, 32.55, 0.5 (*not .5*) etc.

2. Decimal-inch system

(ANSI standard)

Examples 0.25 (*not .25*), 5.375 etc.

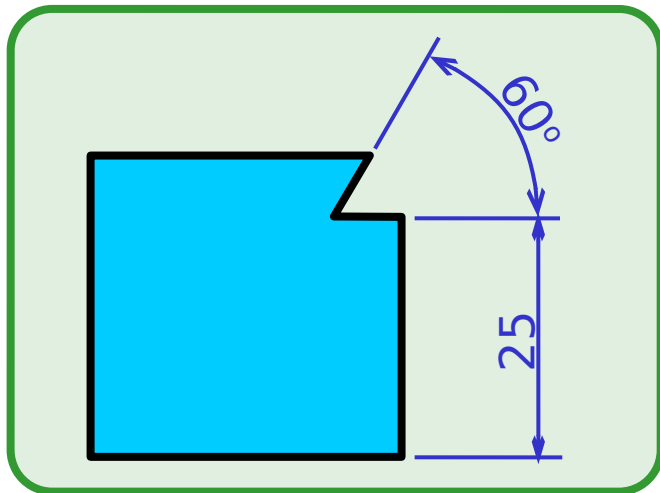
3. Fractional-inch system

Examples $\frac{1}{4}$, $5\frac{3}{8}$ etc.

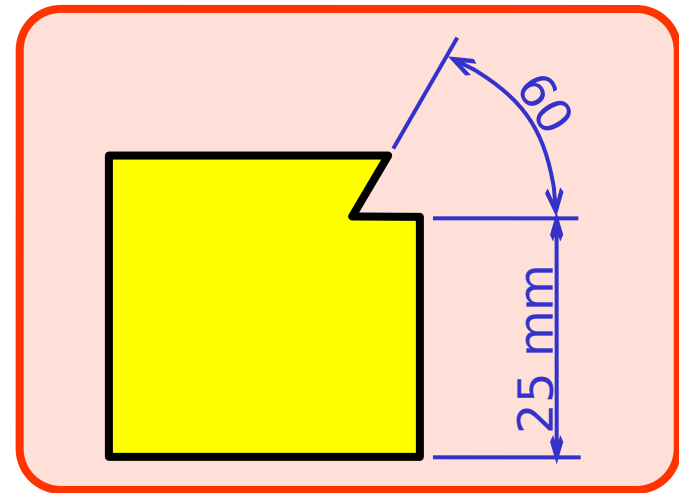
Dimension number : Unit

- **Length** dimension is expressed in **millimeters** **without** a necessity to specify a unit symbol
 - **Angular** dimension is expressed in **degree** with a symbol “°” places behind the number (and if necessary **minutes** and **seconds** may be used together).
-

Good practice



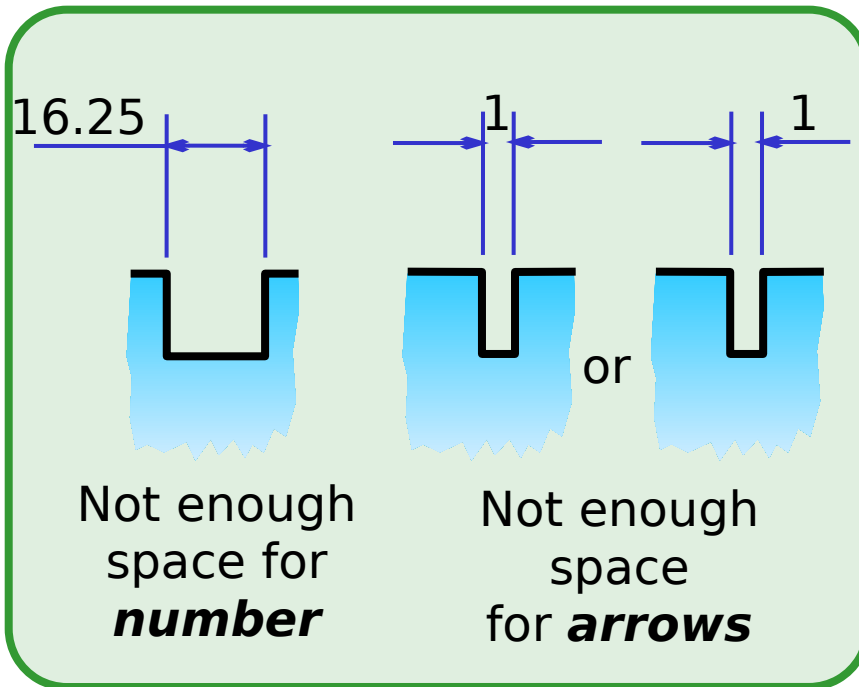
Poor practice



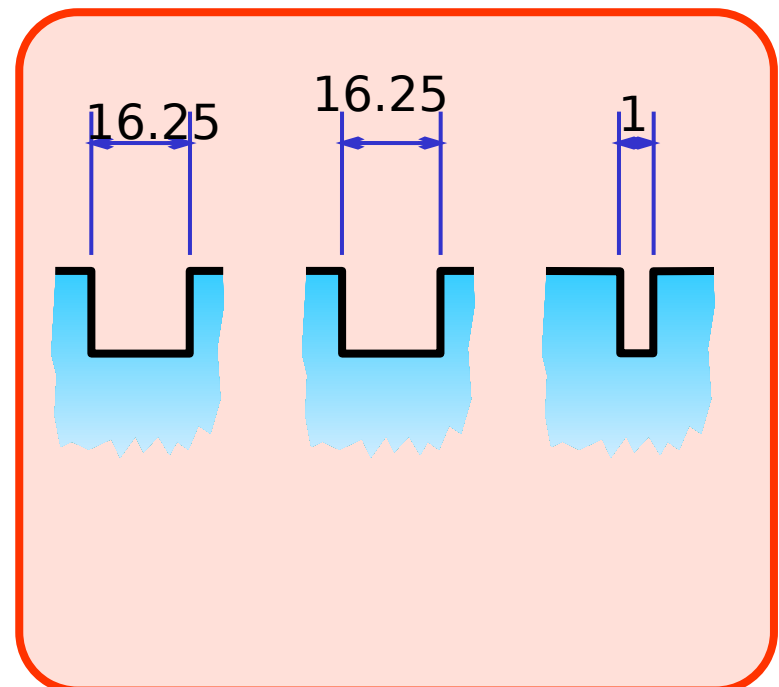
Dimension number : Narrow space situation

- If there is **not** enough space for number or arrows, put it **outside** either of the extension lines.

Good practice



Poor practice



Dimension number : Orientation

1. Aligned method (This course)

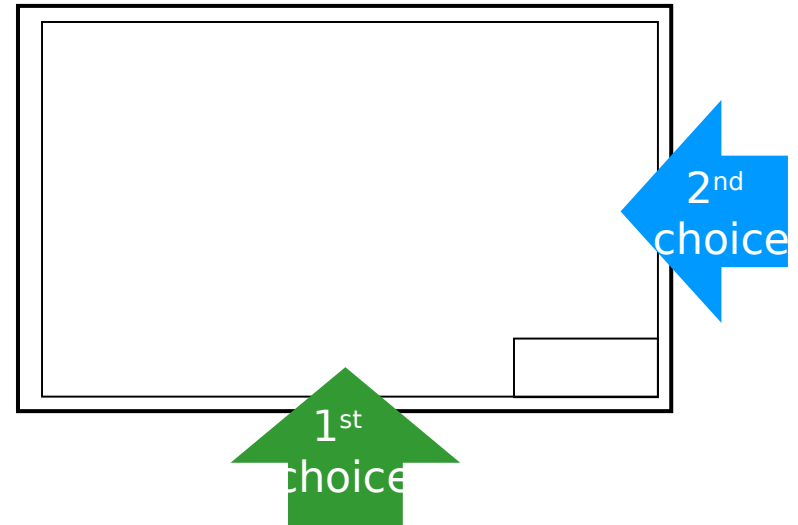
The dimension figures are placed so that they are readable from the

bottom or **right side** of the drawing.

2. Unidirectional method

The dimension figures are placed so that they can be read from the

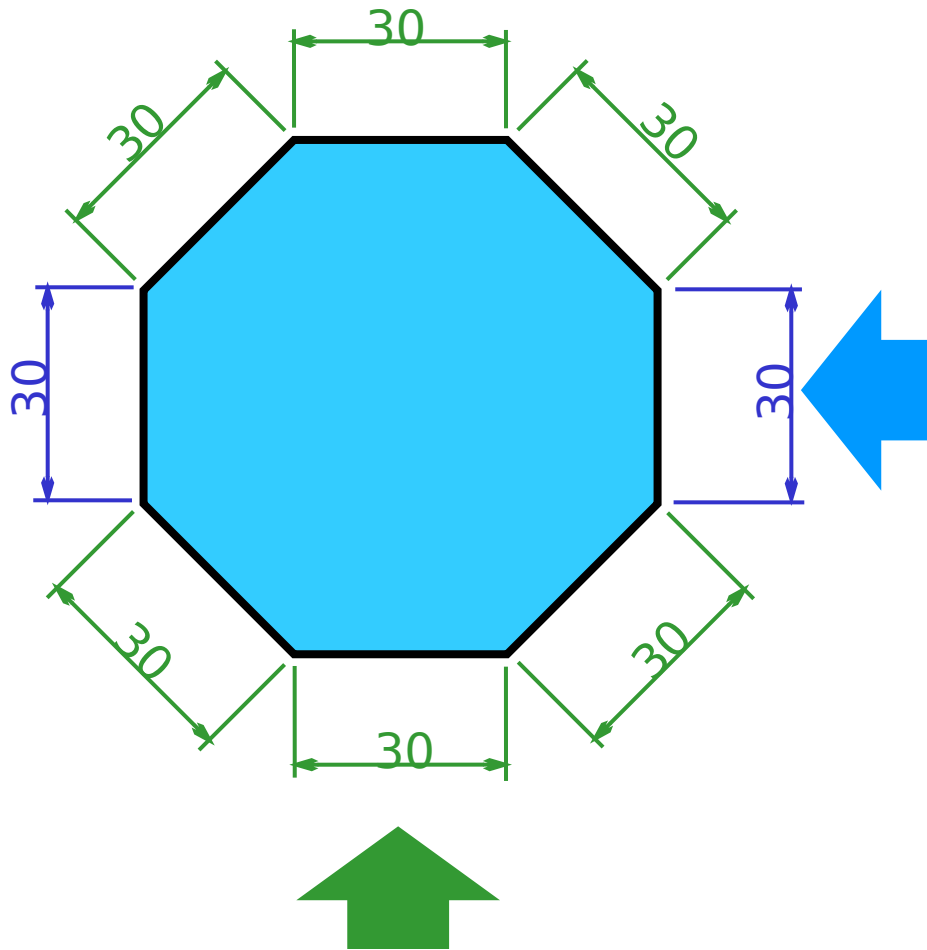
bottom of the drawing.



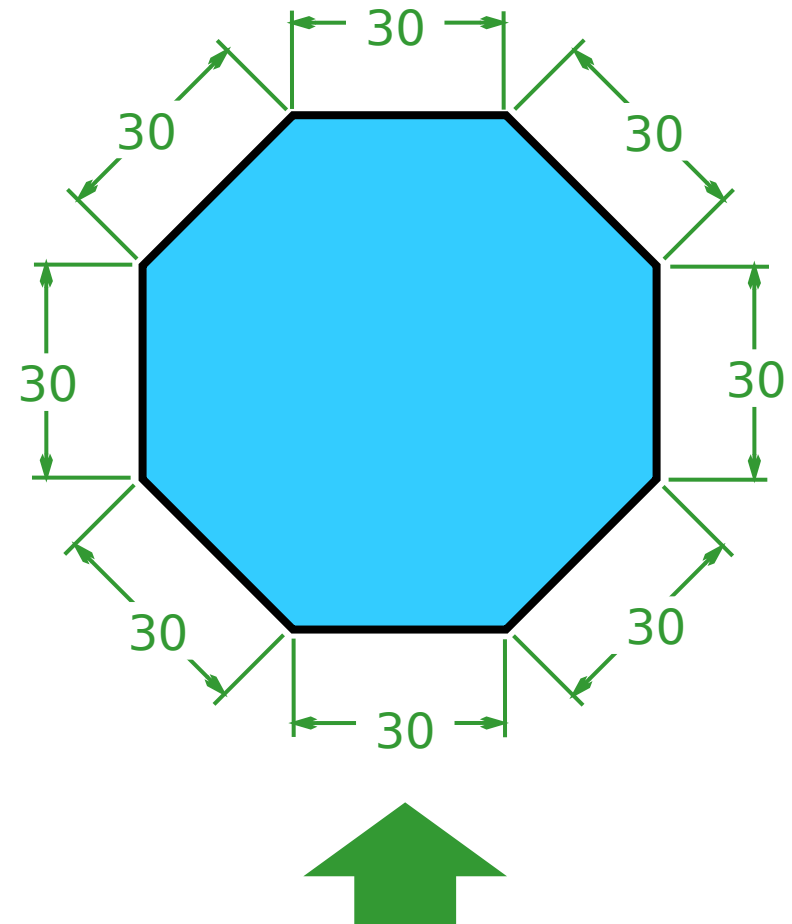
Do not apply both systems on the same drawing or on the same series of drawing (JIS Z8317).

EXAMPLE : Orientation of a length dimension

1. Aligned method (This course)

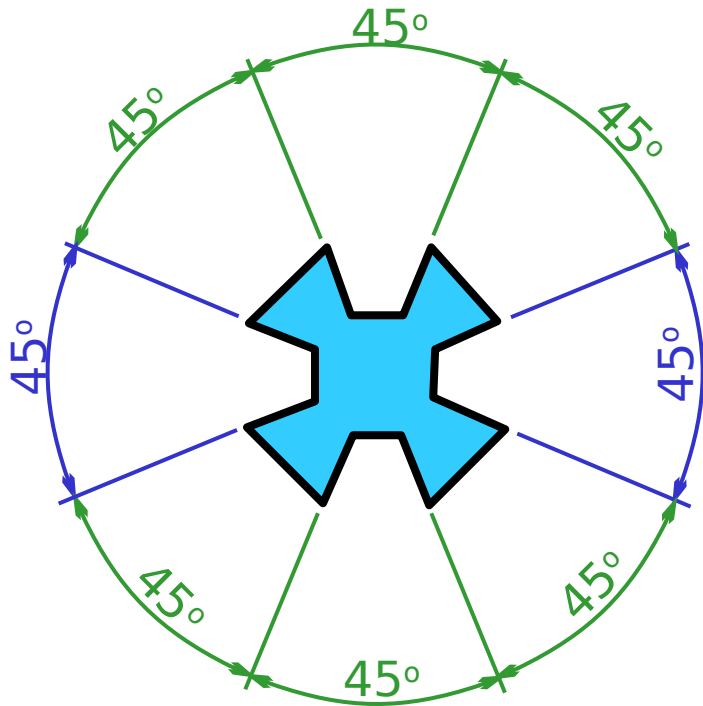


2. Unidirectional method

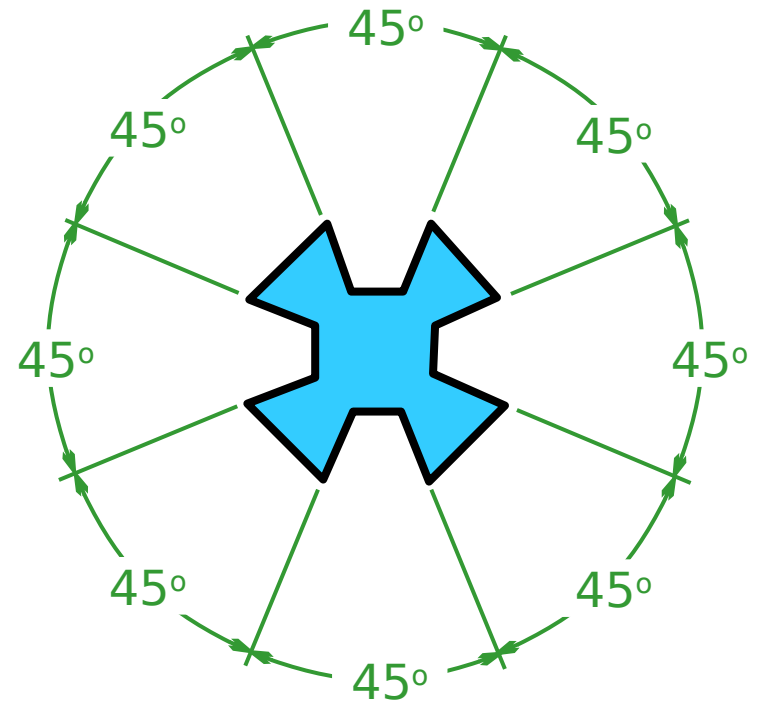


EXAMPLE : Orientation of an angular dimension

1. Aligned method (This course)



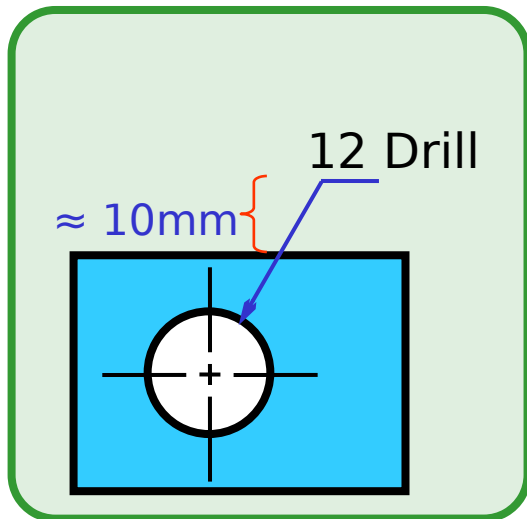
2. Unidirectional method



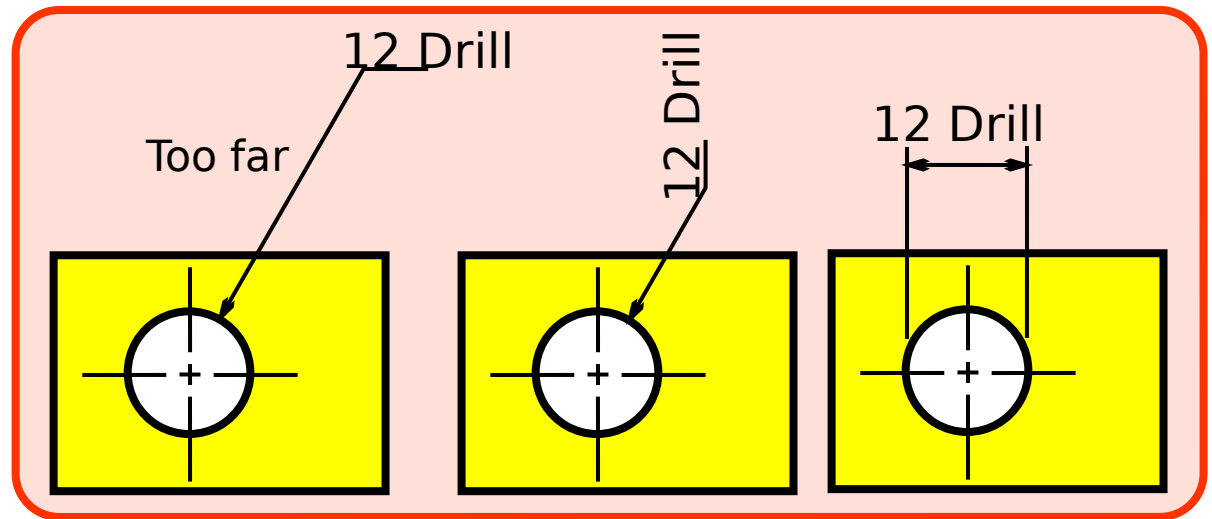
Local notes

- Lettered with **2H** or **HB** pencil and the height of $2.5 \sim 3 \text{ mm}$
- Must be used in a combination with a leader line.
- Place near to the feature which they apply but should be placed outside the view.
- Placed above the bent portion of a leader line. (This course)
- Always be lettered **horizontally**.

Good practice

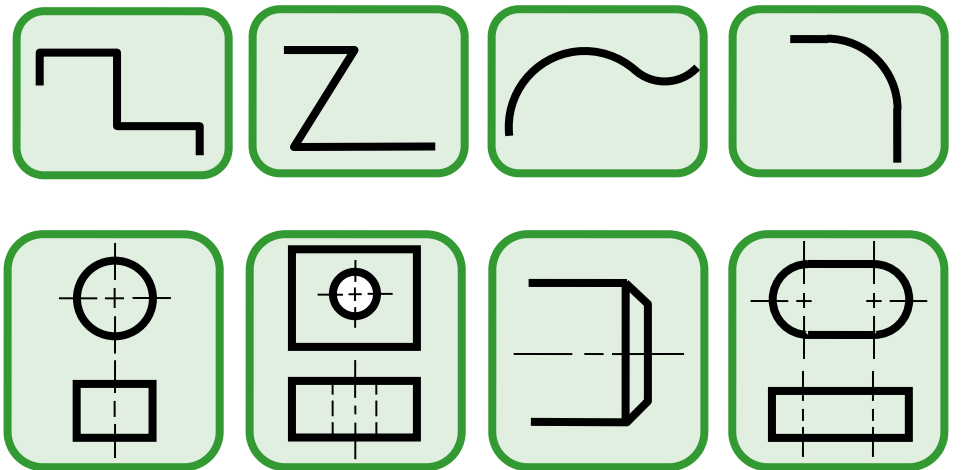


Poor practice





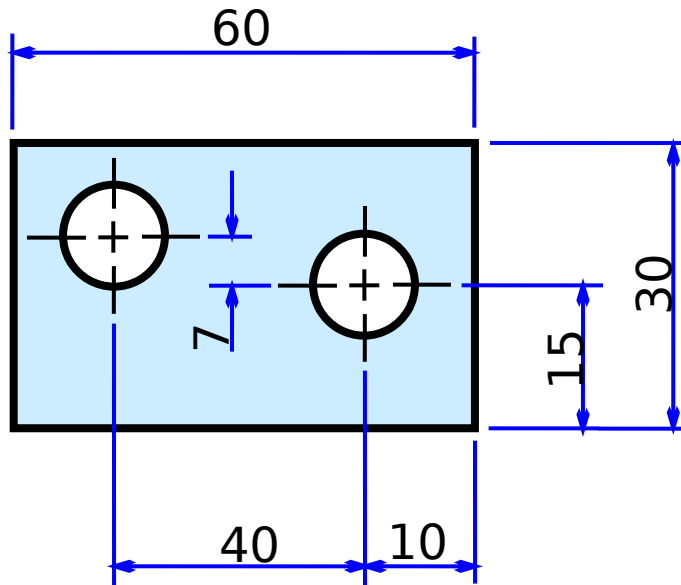
Dimensioning the object's features



Length

Information to be dimensioned	Dimensioning components
- <i>Length</i> of an edge - <i>Distance</i> between features	Extension and dimension lines, and dimension number

Example

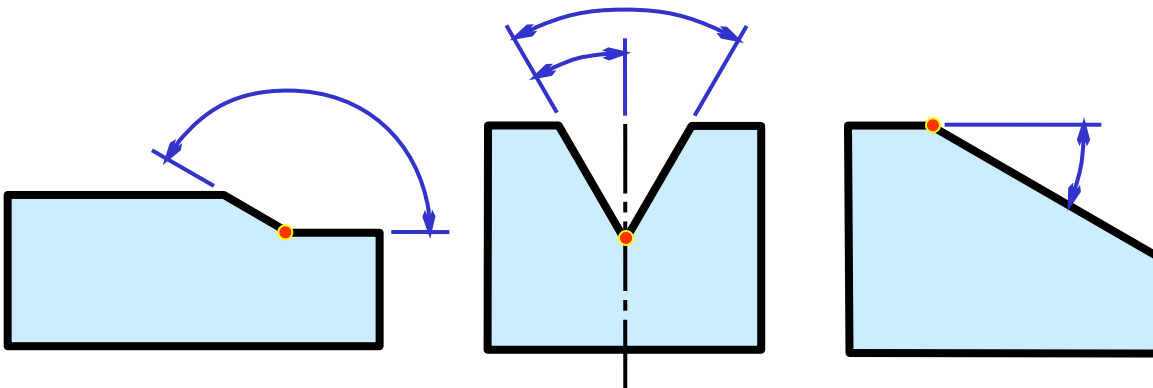


Angle

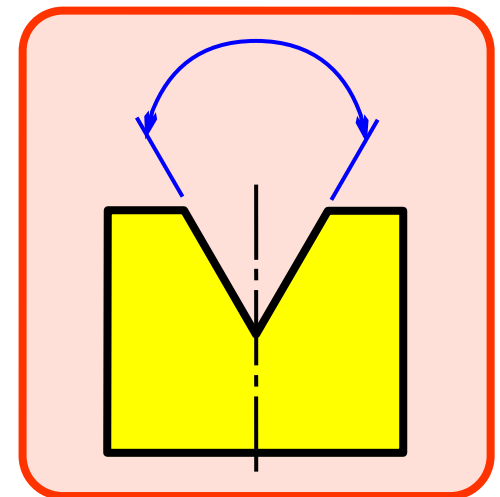
Information to be dimensioned	Dimensioning components
- Angle between edges.	Extension and <i>circular</i> dimension lines, and dimension number

- A **circular dimension line must** have its center at the vertex of the angle.

Example



Poor practice



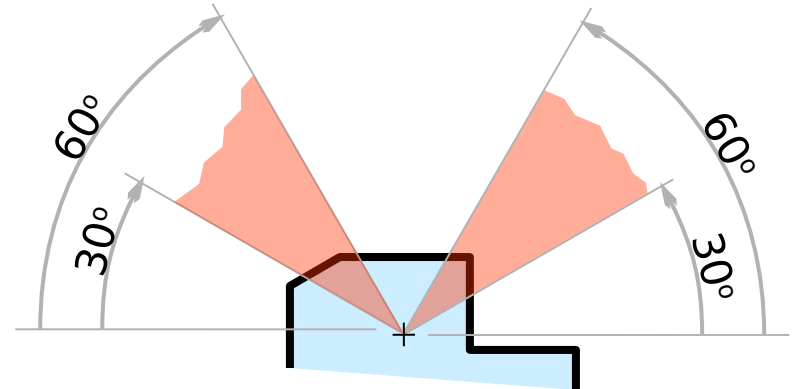
Arc

Information to be dimensioned	Dimensioning components
- <i>Radius</i>	Leader line and local note
- <i>Location of its center</i>	Extension and dimension lines, and dimension number

■ The letter “R” is written in front of a number to emphasize that

the number represents radius of an arc.

■ Leader line must be aligned with a radial line and has an inclined angle between 30 ~ 60 degs to the horizontal.

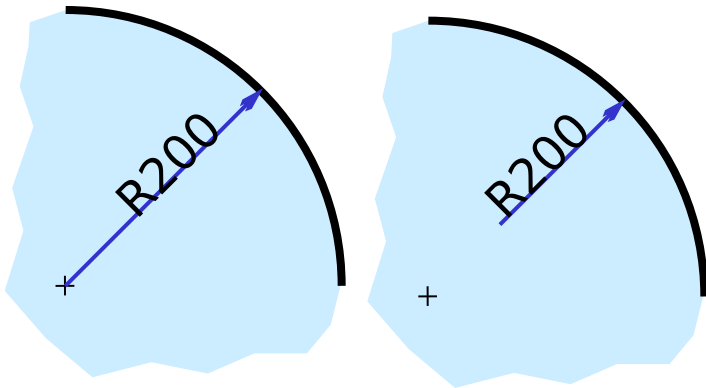


Arc

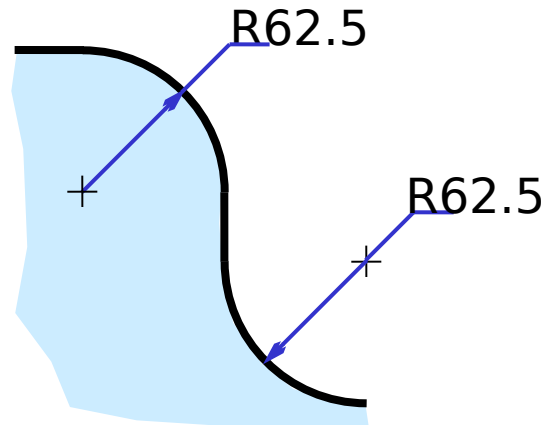
- The note and the arrowhead **should be placed in a concave side** of an arc, whenever there is a sufficient space.

Example : Radius of an arc

Sufficient space for both.

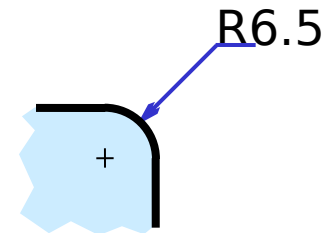


Sufficient space for arrowhead only



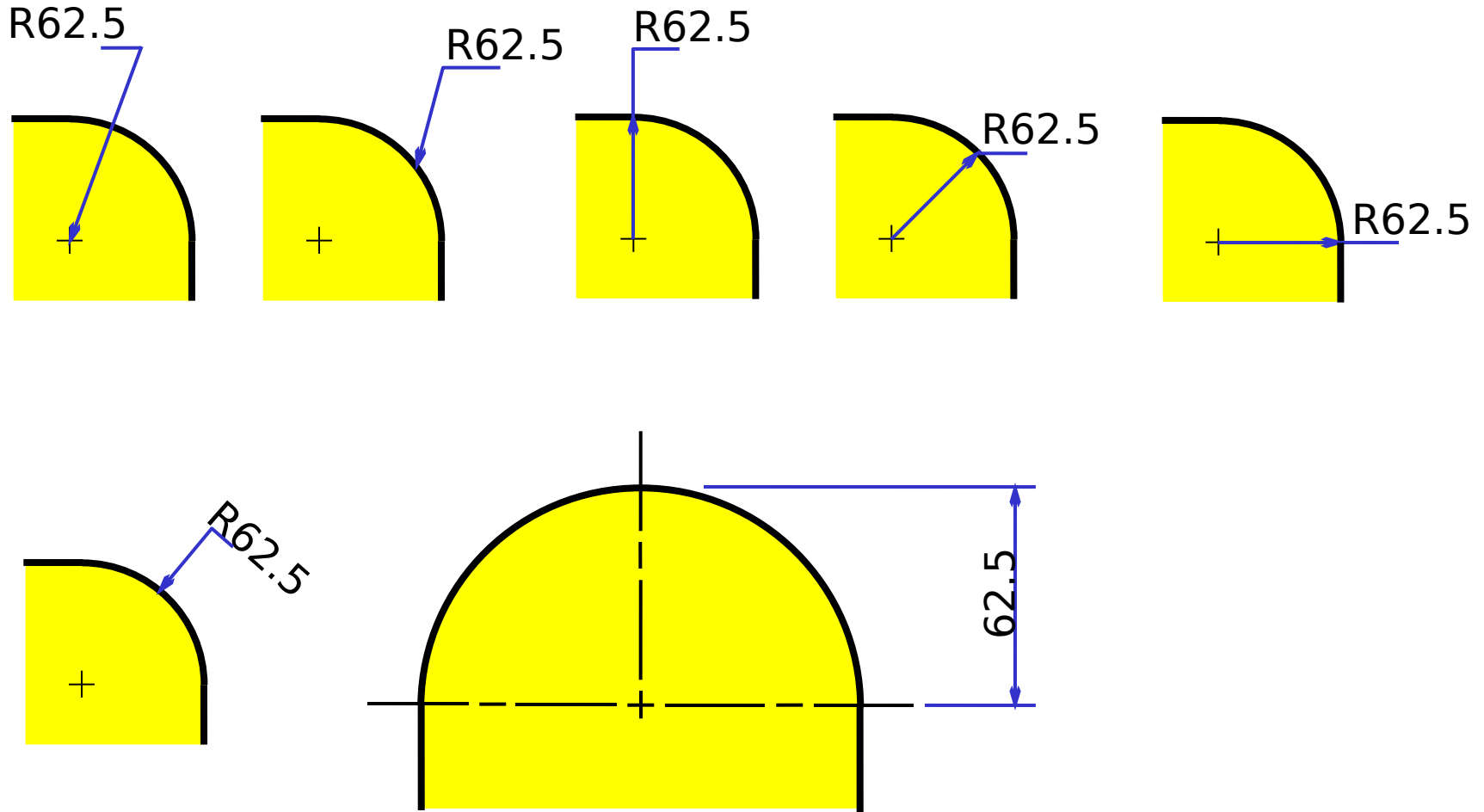
Place a note outside

Insufficient space for both



Place a note and an arrow outside

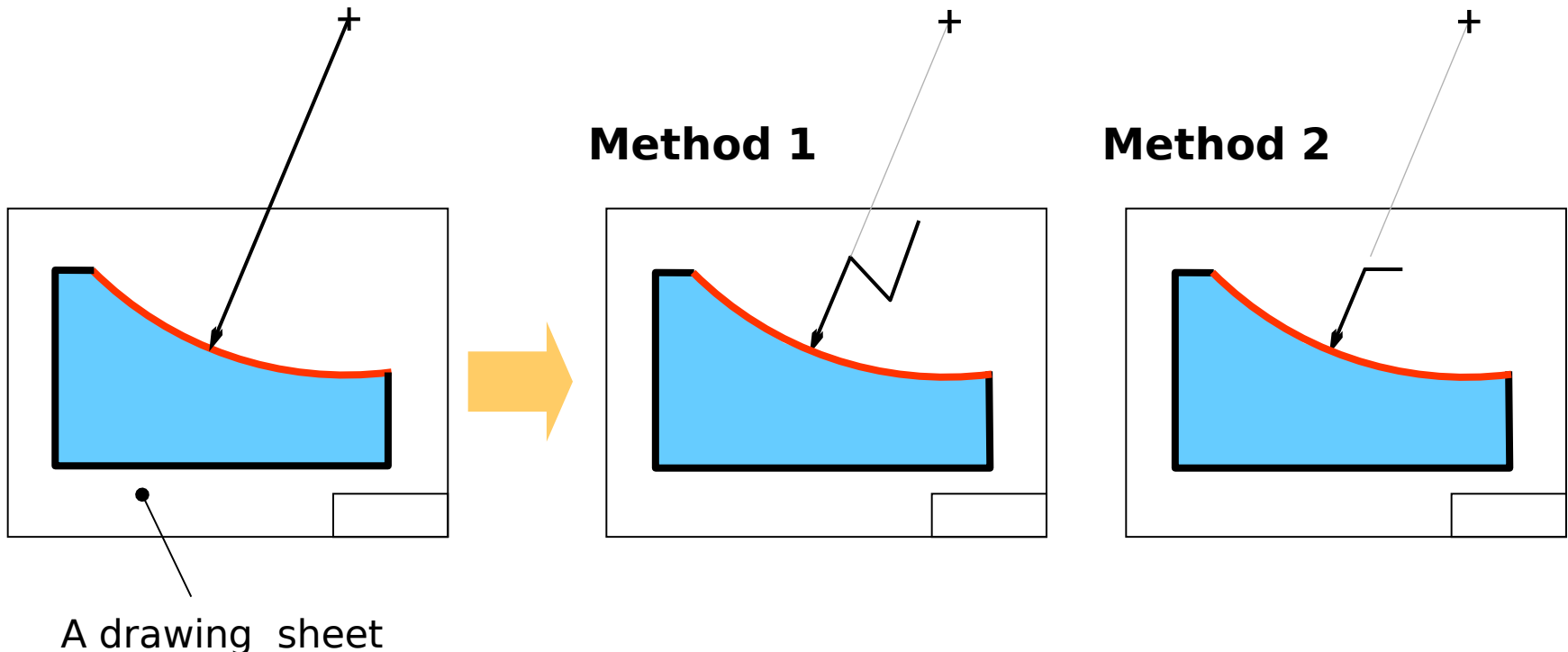
Arc : Common mistakes



Arc

- If the arc has its center lies outside the sheet or interfere with other views, use the **foreshortened radial dimension line**.
-

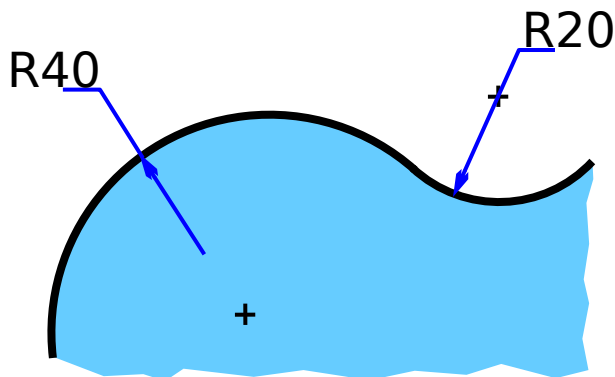
Example



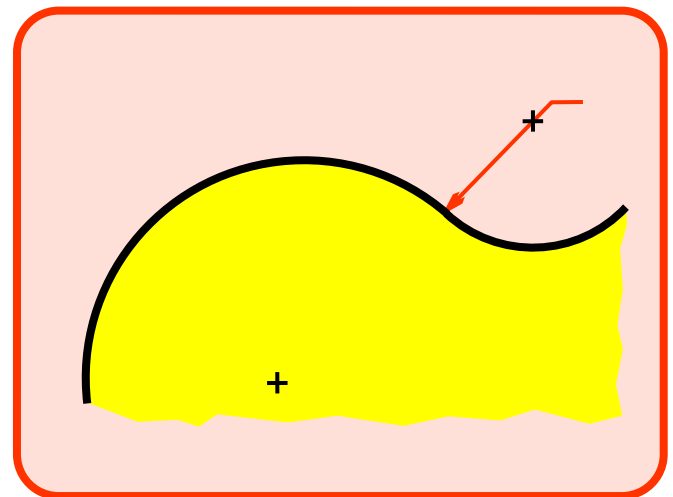
Curve (A combination of arcs)

Information to be dimensioned	Dimensioning components
- <i>Radius</i>	Leader line and local note
- <i>Location of its center</i>	Extension and dimension lines, and dimension number

Example : Radius of the arcs



Poor practice

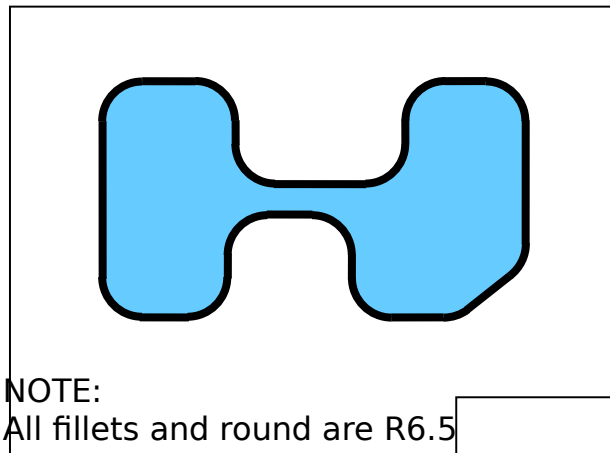


Fillets and Rounds

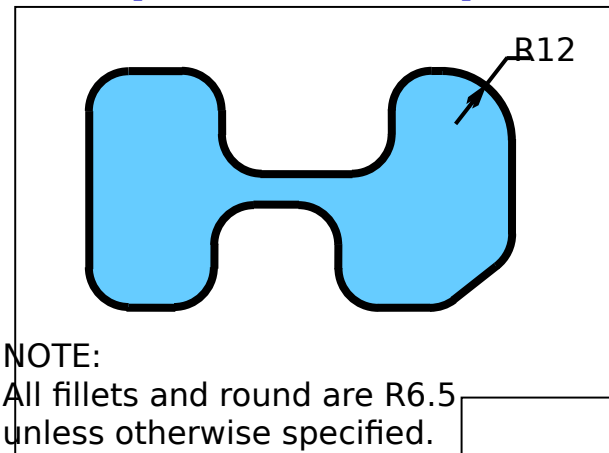
Information to be dimensioned	Dimensioning components
- <i>Radius</i>	1. Leader line and local note 2. General note 3. Combination of both

Example

1. All fillets and rounds have an equal radius



2. Most of fillets and rounds have an equal radius except for some places

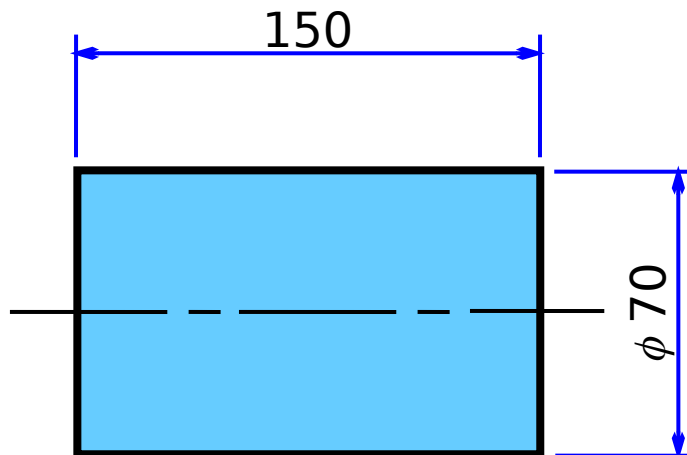


Cylinder

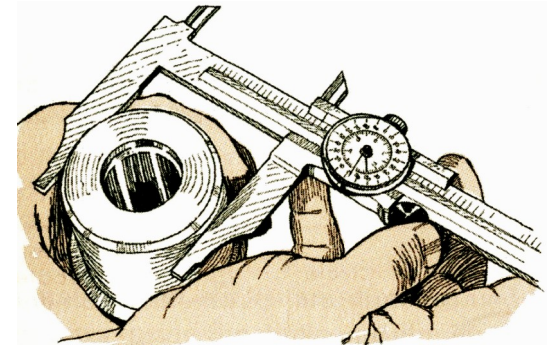
Information to be dimensioned	Dimensioning components
- <i>Diameter</i> - <i>Length</i>	Extension and dimension lines, and dimension number

- Diameter should be given in a **longitudinal view** with the symbol " ϕ " placed in front of a number.

Example

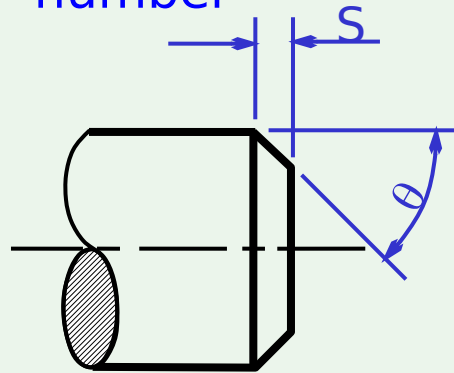
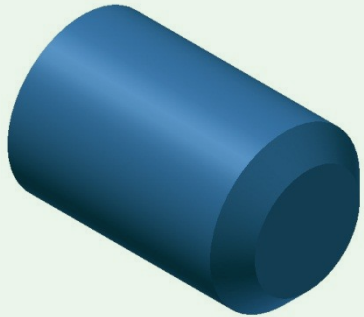


Measurement of object's diameter

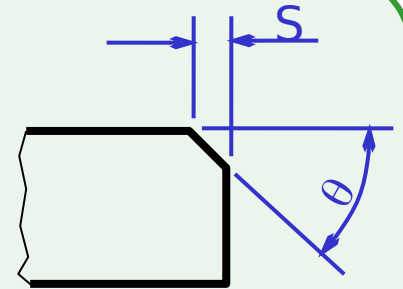
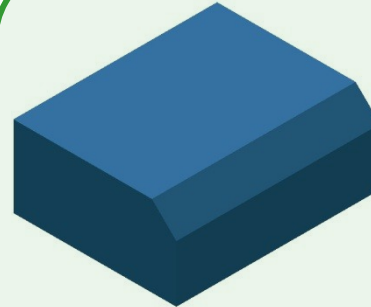
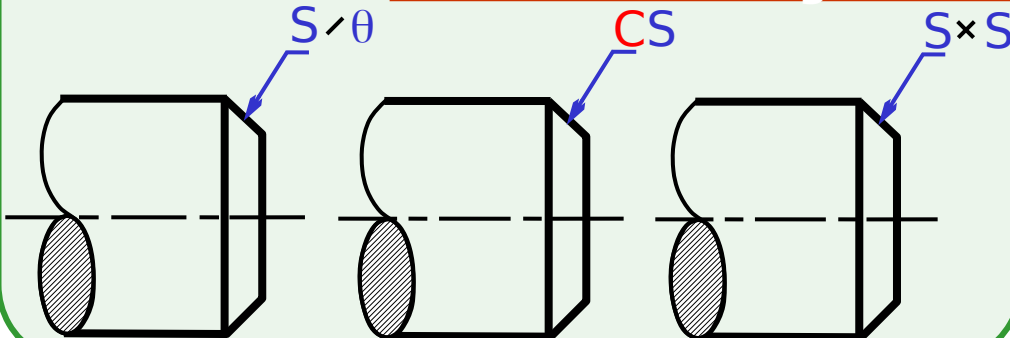


External chamfer

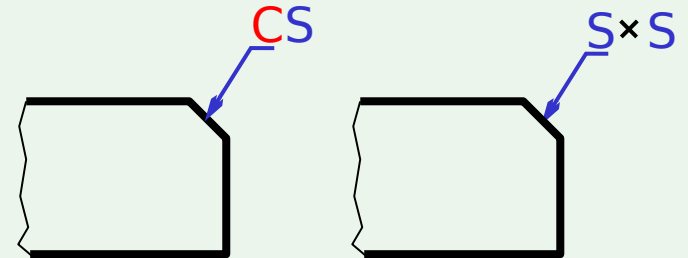
Information to be dimensioned	Dimensioning components
- <i>Linear distance</i> - <i>Angle</i>	1. Leader line and local note - or 2. Extension and dimension lines, and dimension number



Case of 45 degrees



Case of 45 degrees



Hole

Information to be dimensioned	Dimensioning components
- <i>Diameter</i> - <i>Depth</i>	Leader line and local note
- <i>Location of its center</i>	Extension and dimension lines, and dimension number
- <i>Number of holes having an identical specification</i>	Local note

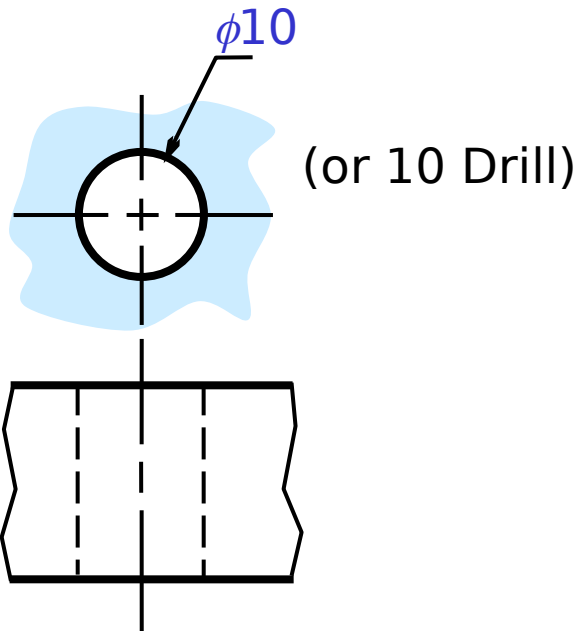
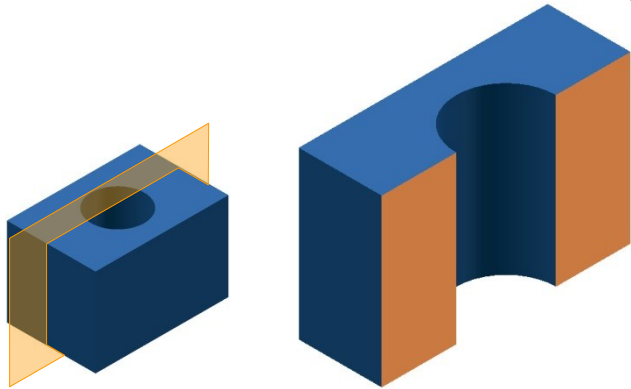
■ Diameter and depth of the hole should be given in a circular view.

■ Location of a hole should be given in circular view.

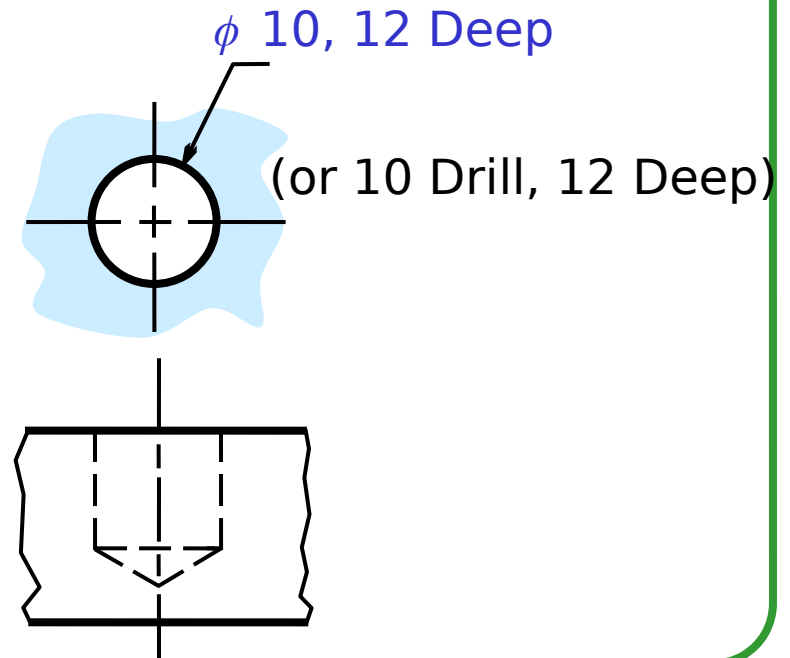
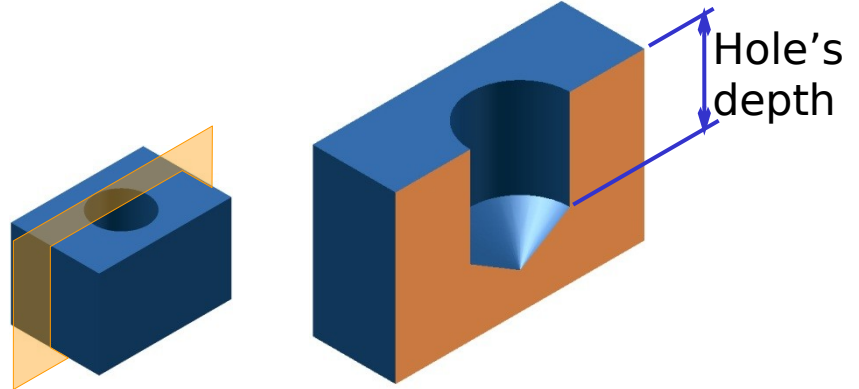
Small hole :

Specifying a diameter and a depth

1) Through hole

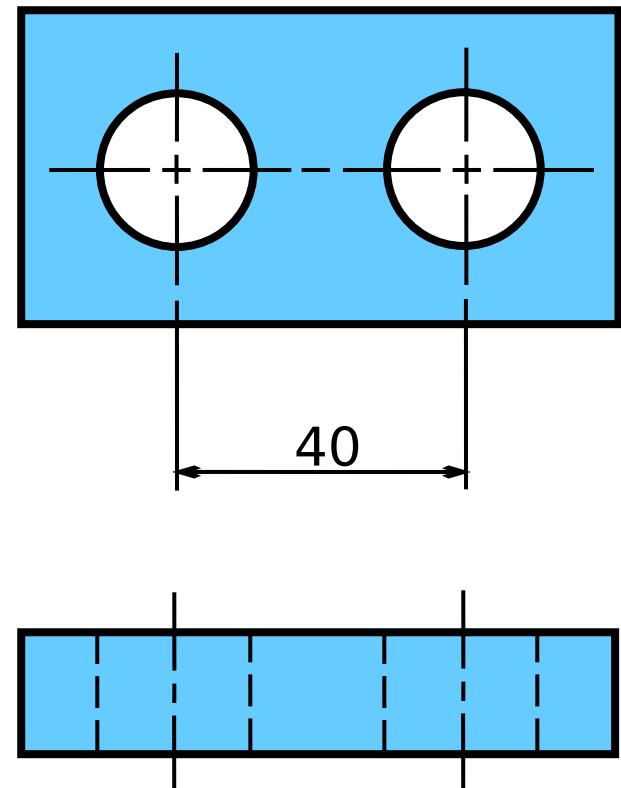
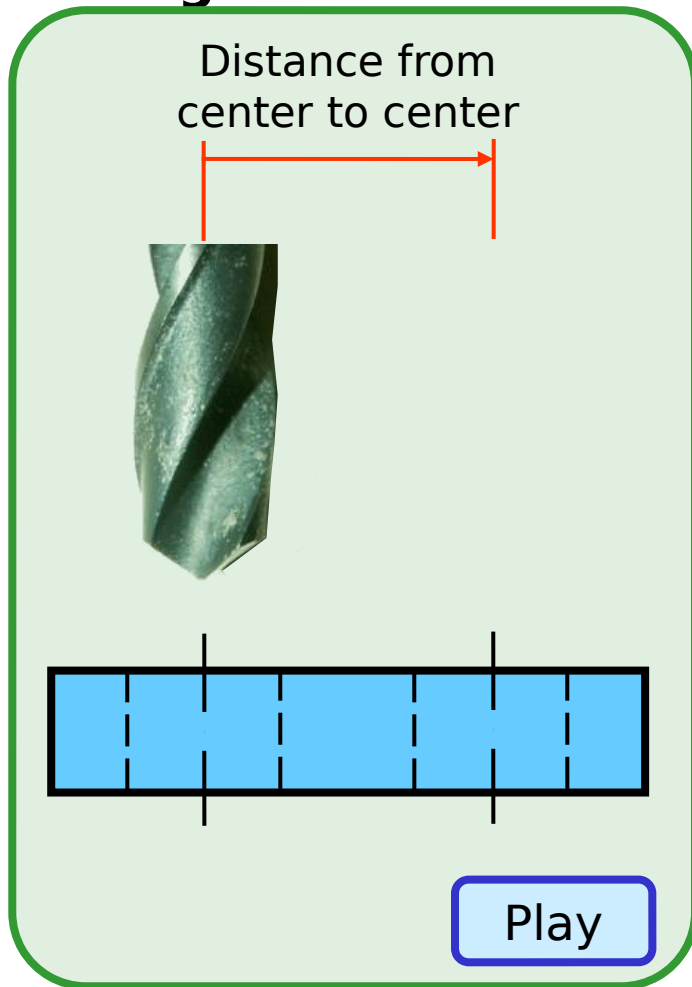


2) Blinded hole



Small hole : Specifying a location

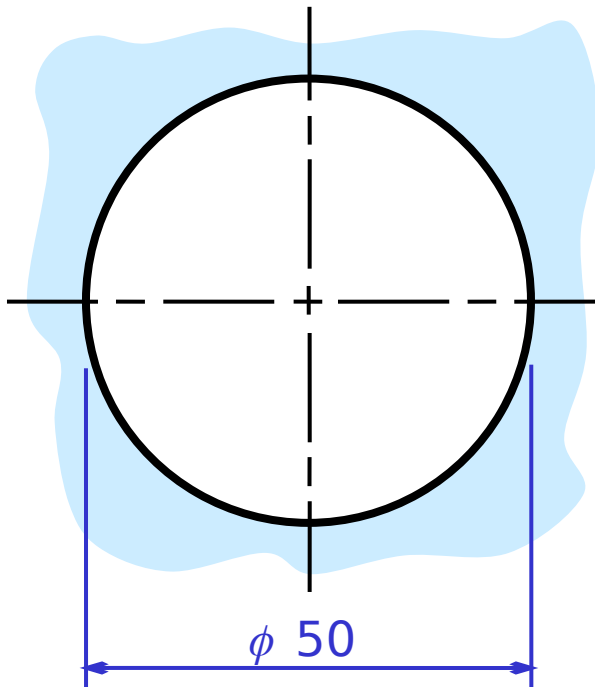
Drilling a hole



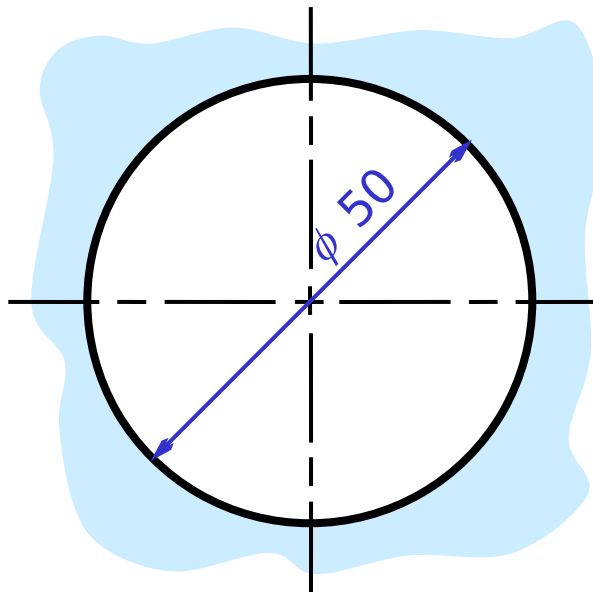
Large hole

■ Three possible methods are:-

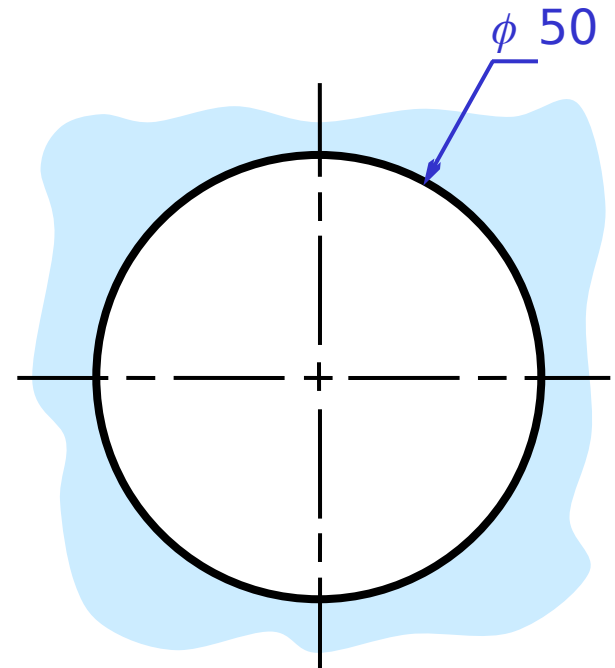
**Use extension and
dimension lines**



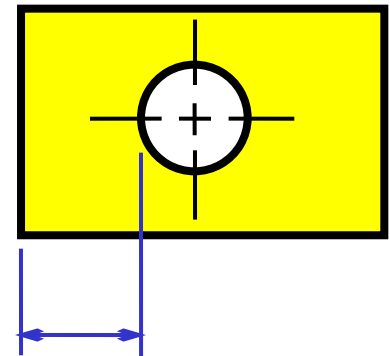
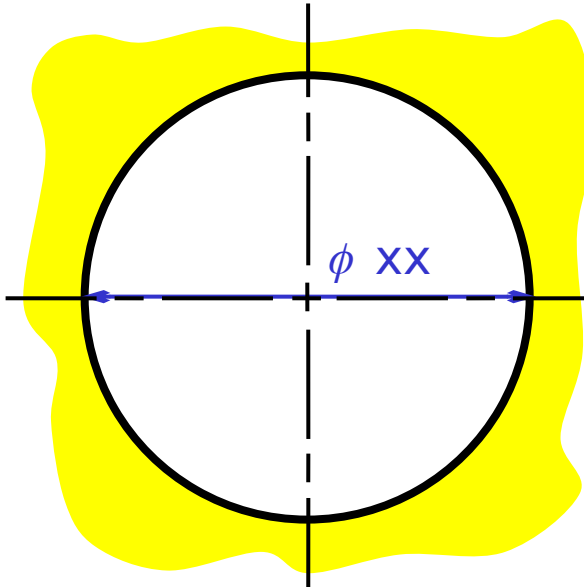
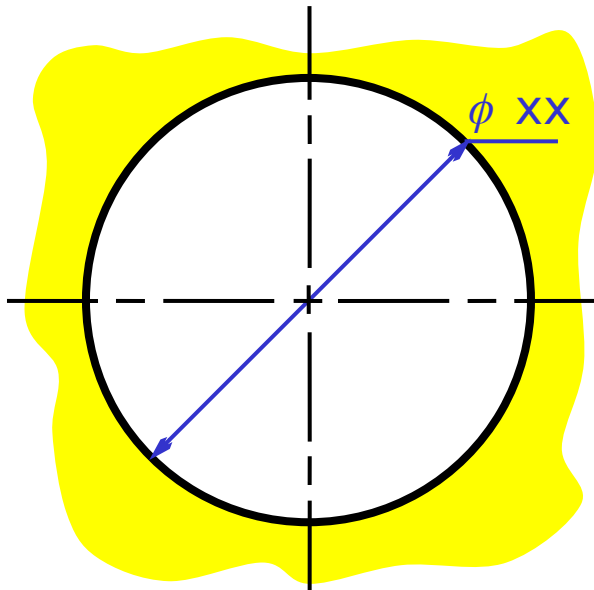
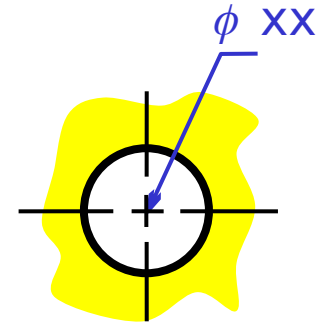
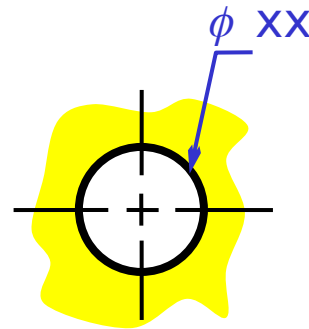
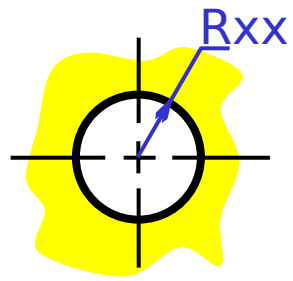
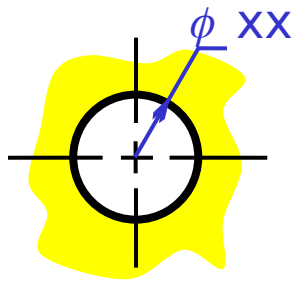
**Use diametral
dimension line**



**Use leader line and
note**

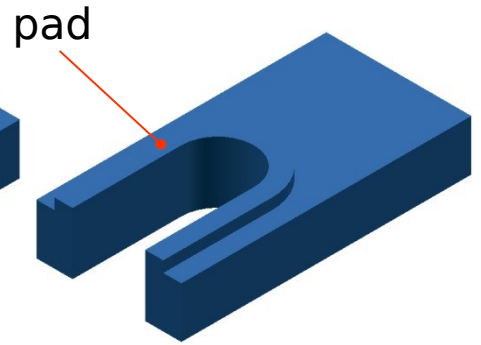
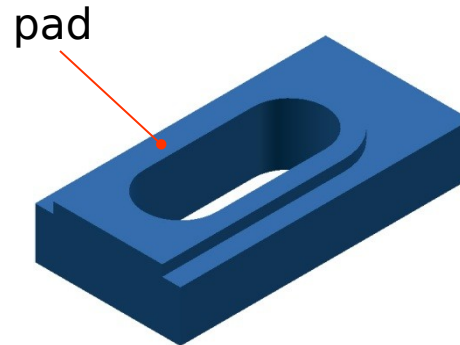
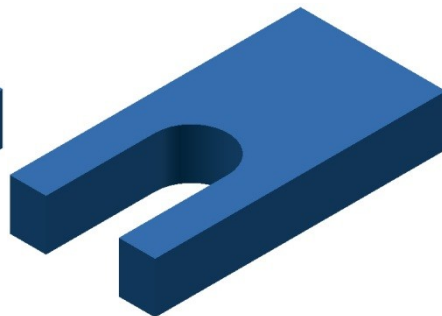
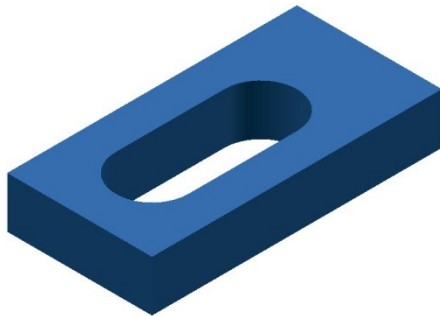


Hole : Common mistakes



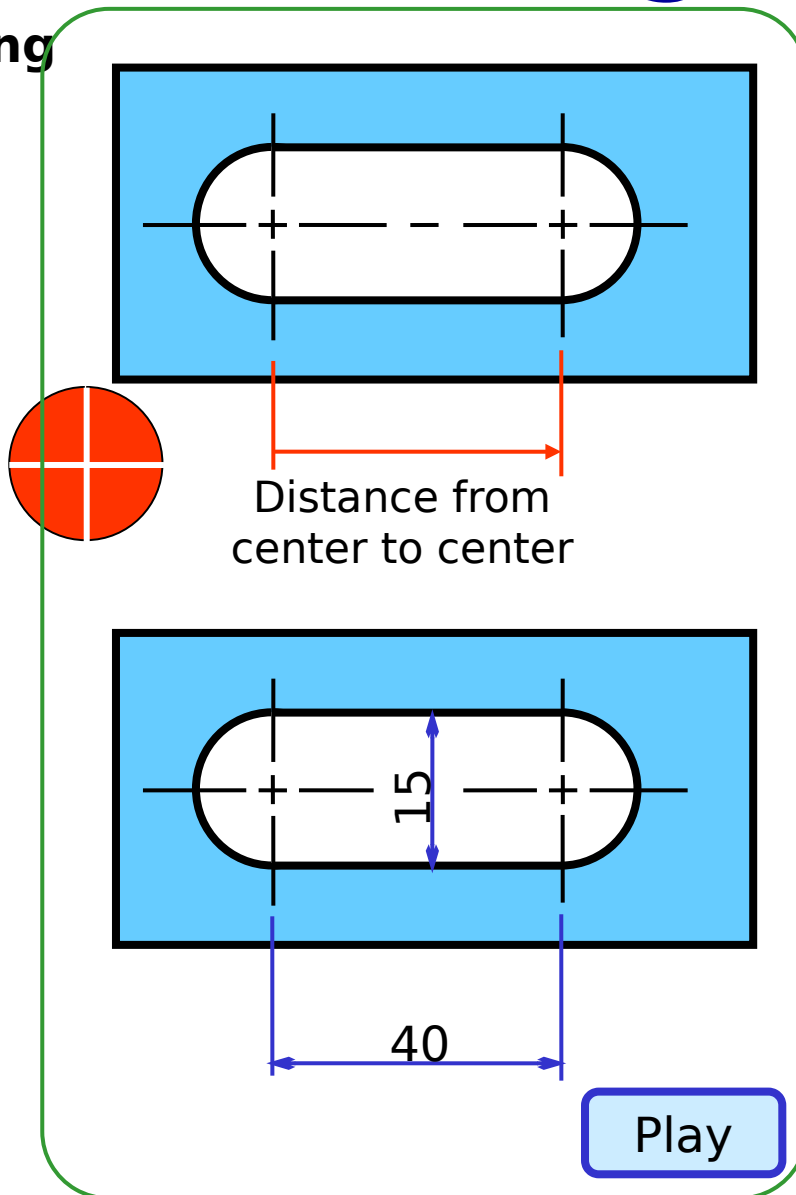
Straight slot

Information to be dimensioned	Dimensioning components
- <i>Length</i> - <i>Width</i> - <i>Location</i>	Extension and dimension lines, and dimension number

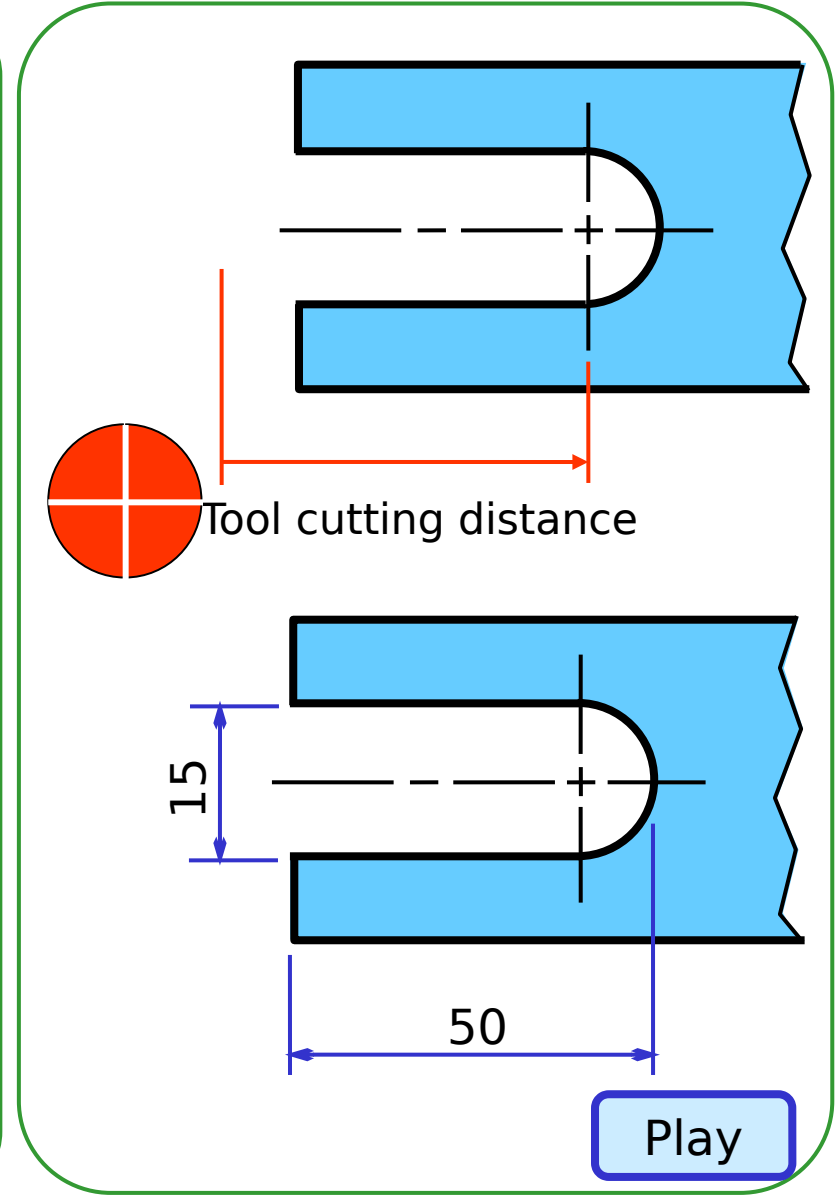


Straight slot

**Machining
process**



**Dimen-
sioning**



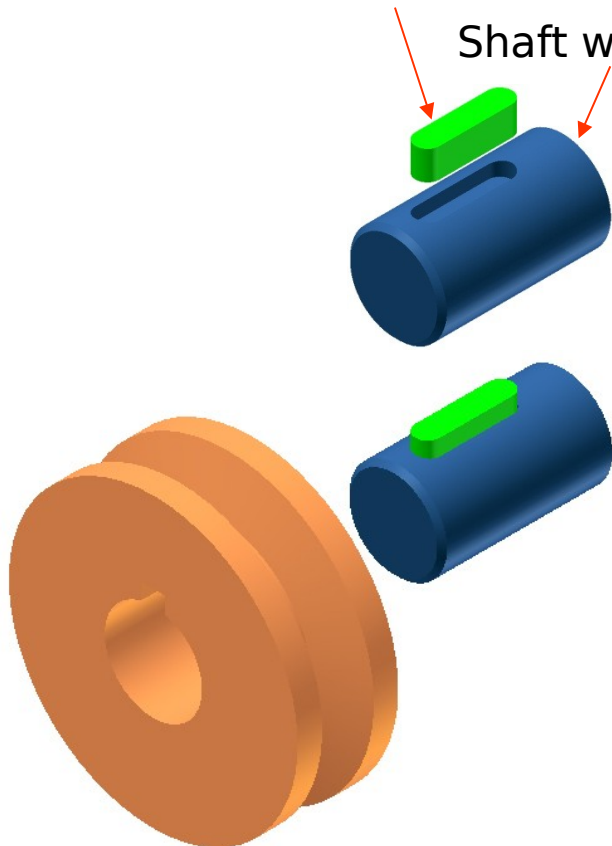
Keyseat

- Dimensioned according to the **standard sizes** of a key

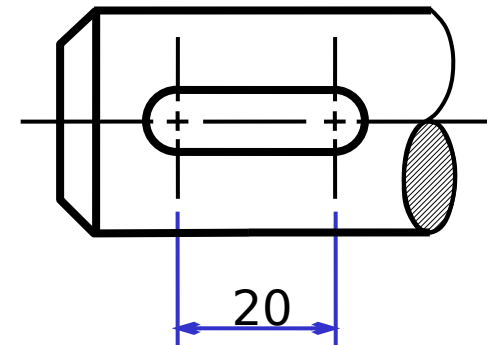
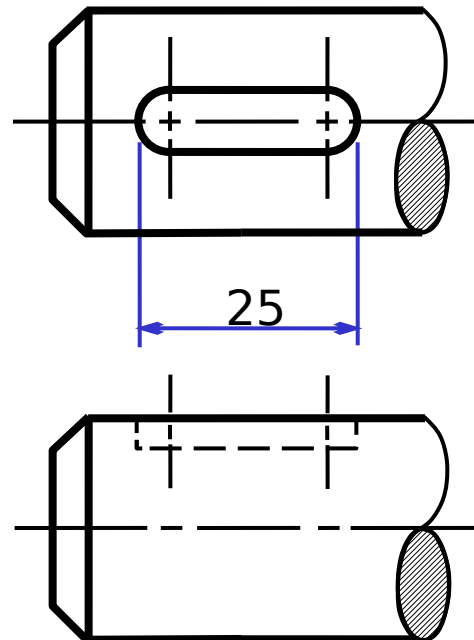
or to facilitate a manufacturing process.

Key (standard part)

Shaft with keyseat



Less preferable method



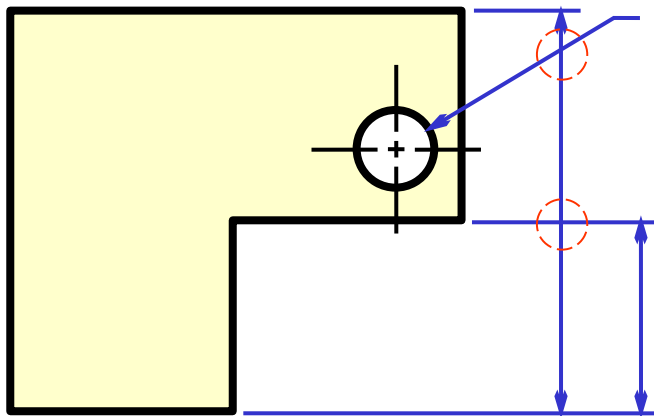


Placement of dimensions

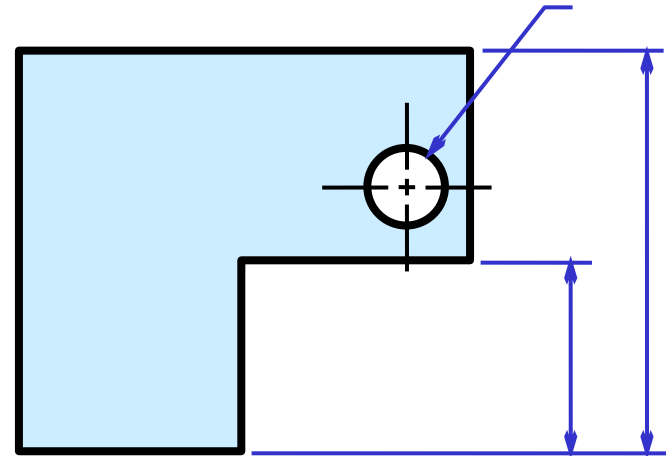
Recommended practice 1

- Extension lines, leader lines **should not** cross dimension lines.

Example



Poor practice

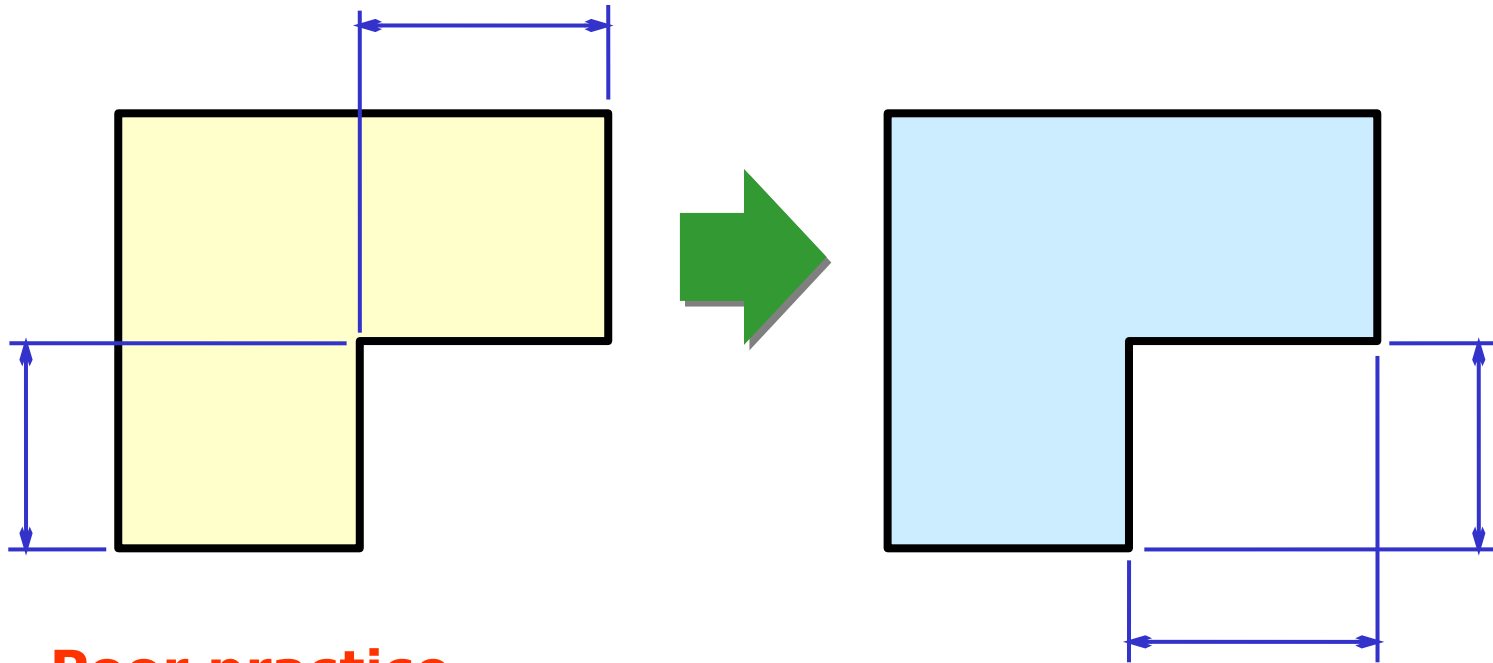


- Place longer dimensions outside shorter ones.

Recommended practice 2

- Extension lines **should be** drawn from the nearest points to be dimensioned.
-

Example

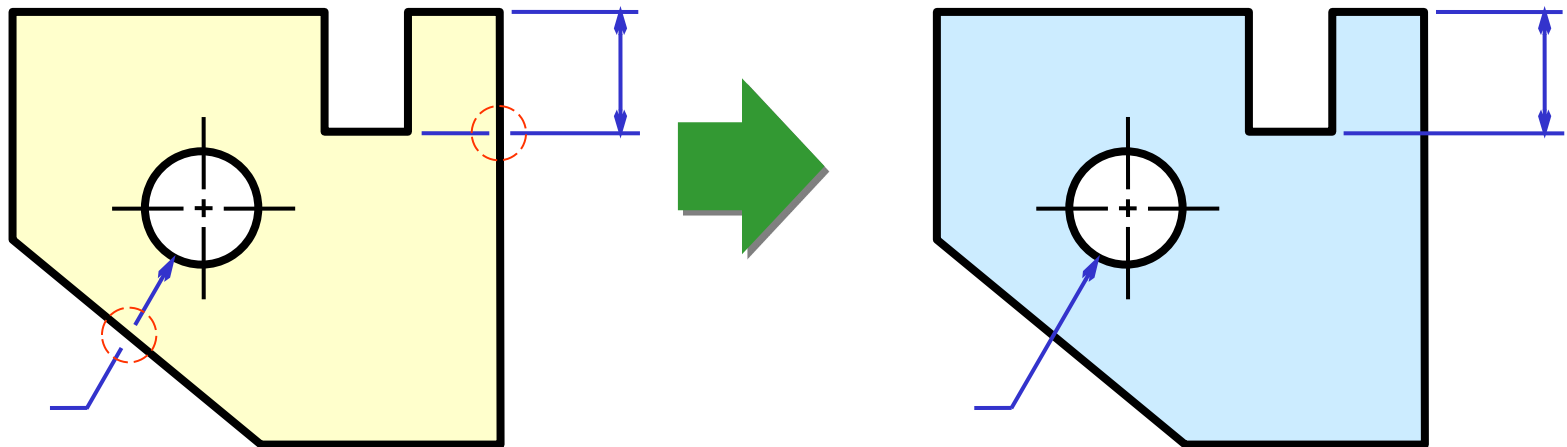


Poor practice

Recommended practice 3

■ Extension lines of an internal feature **can** cross a visible line **without** leaving a gap at the intersection point.

Example

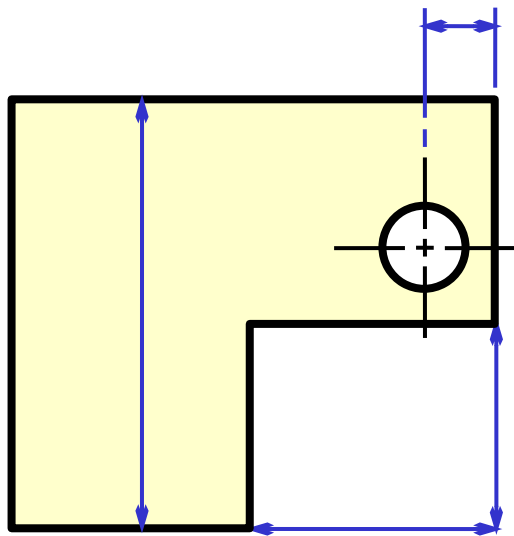


Wrong

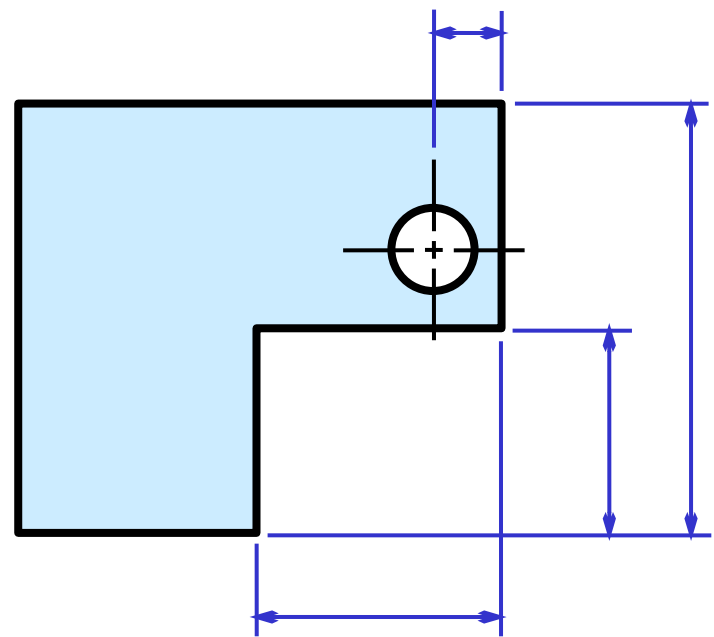
Recommended practice 4

- **Do not** use visible, center, and dimension lines as an extension lines.

Example



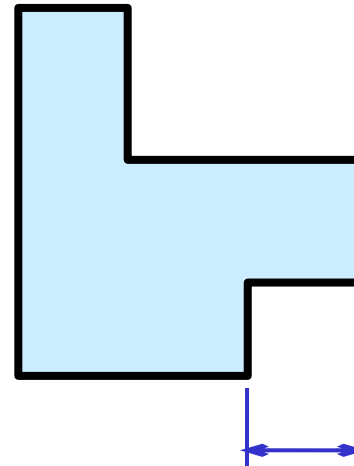
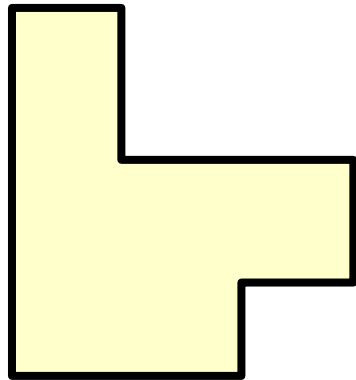
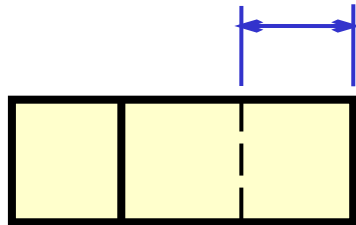
Poor practice



Recommended practice 5

- **Avoid** dimensioning hidden lines.
-

Example

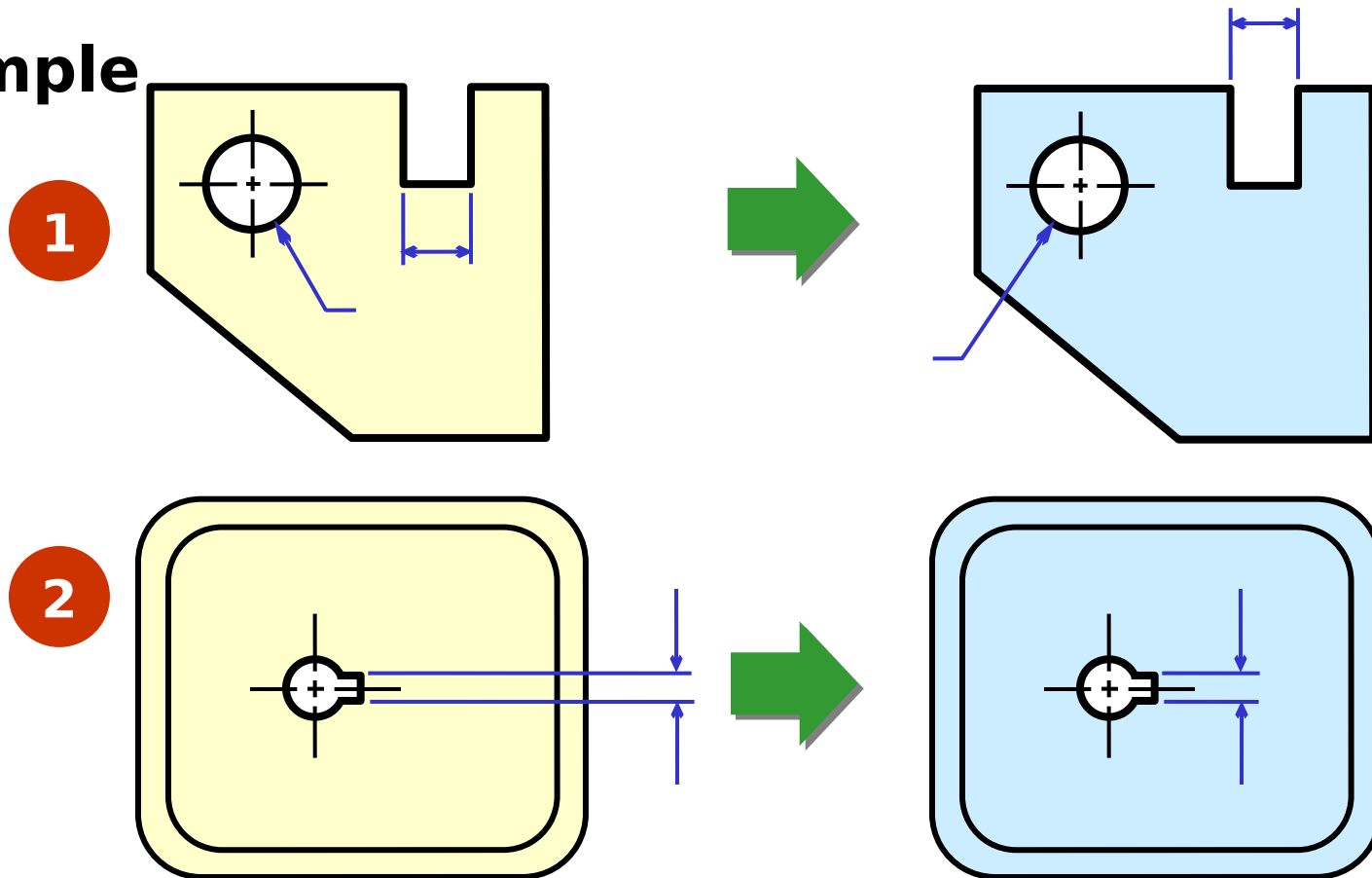


Poor practice

Recommended practice 6

- Place dimensions **outside** the view, unless placing them inside improve the clarity.
-

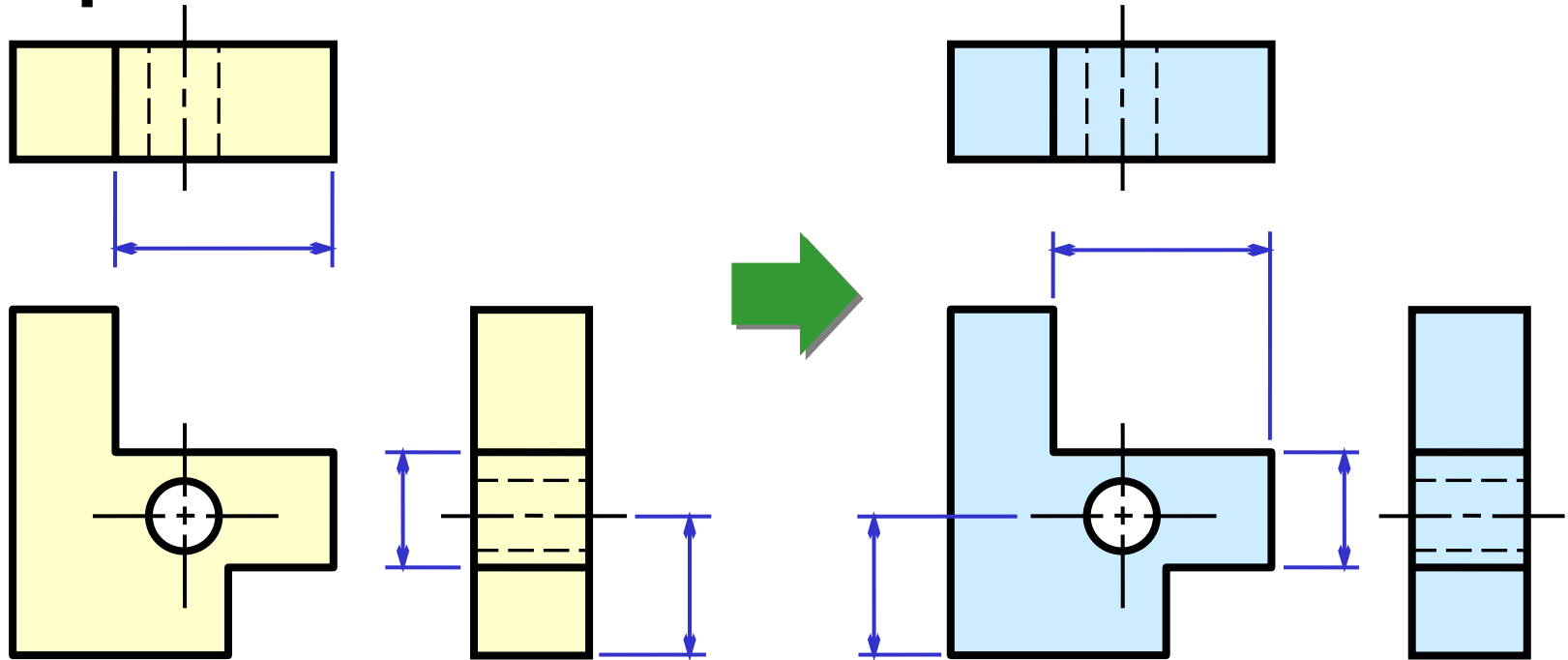
Example



Recommended practice 7

- Apply the dimension to the view that clearly represents the contour or shape of a feature.
-

Example

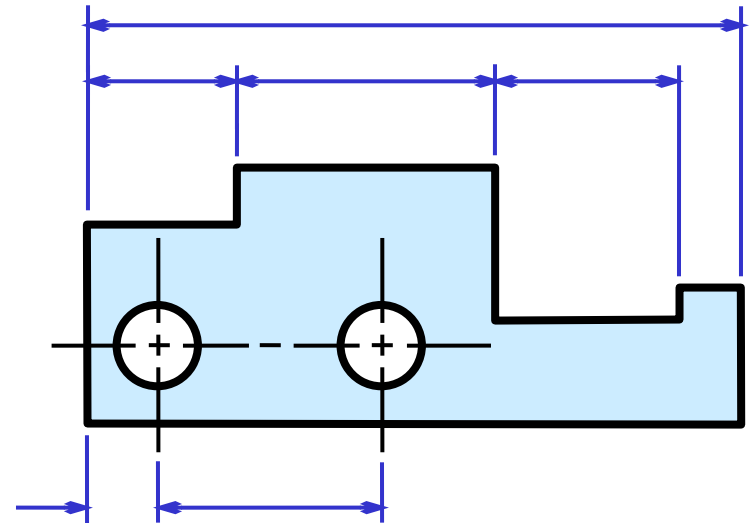
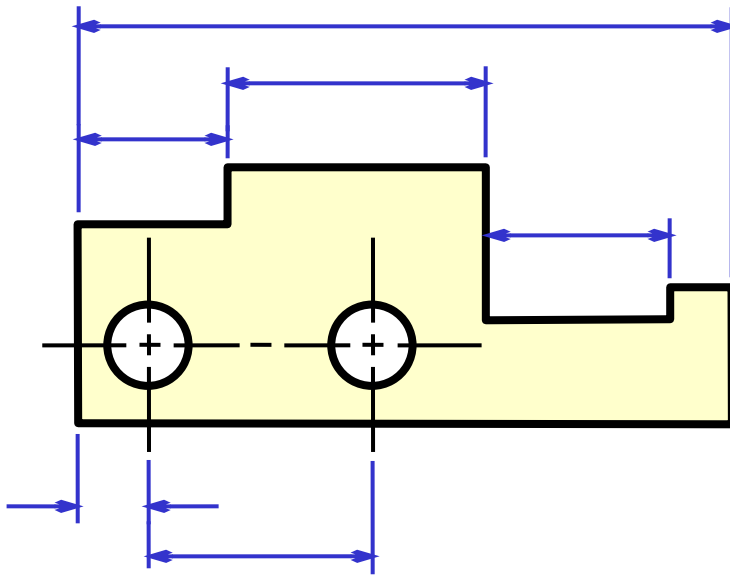


Poor practice

Recommended practice 8

- Dimension lines should be lined up and grouped together as much as possible.
-

Example

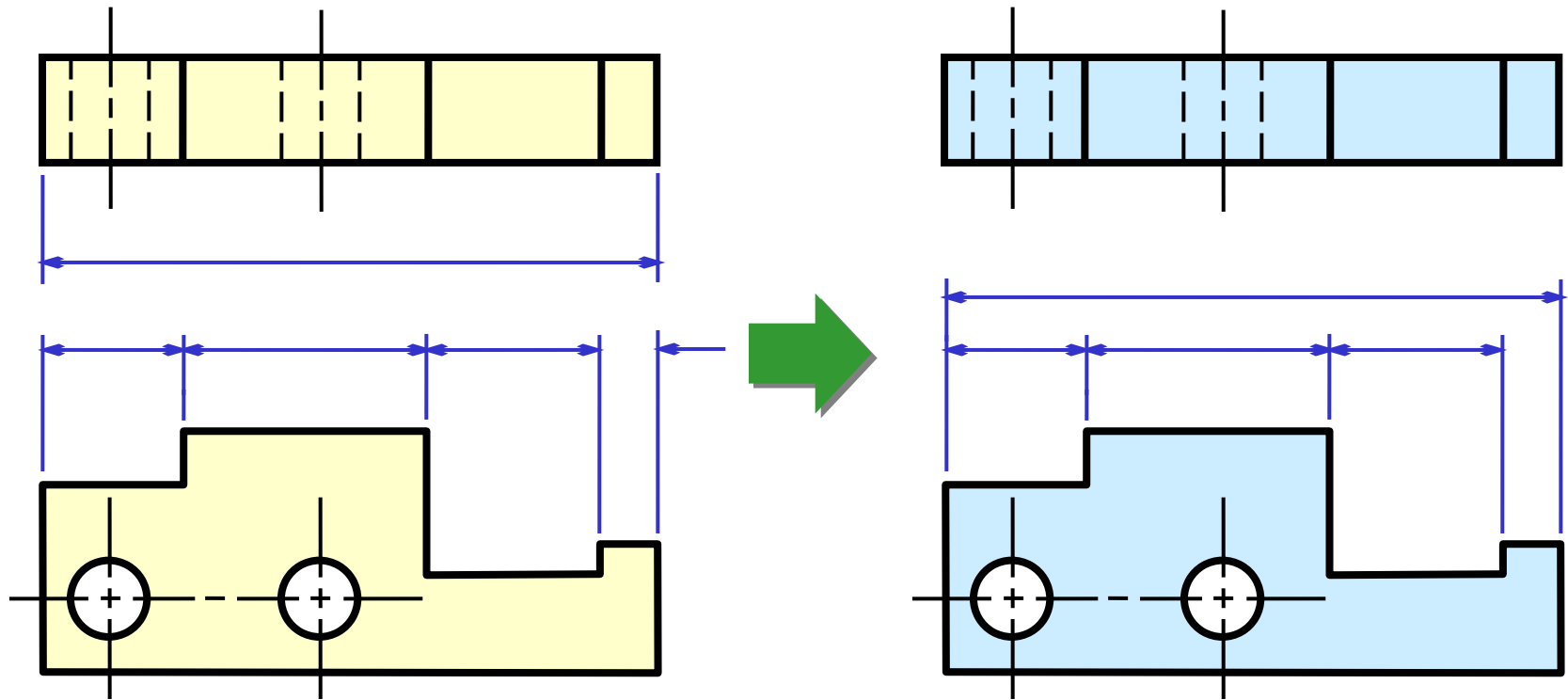


Poor practice

Recommended practice 9

- **Avoid** repeat a dimension (superfluous dimensions).
-

Example



Poor practice



Problem solving steps

Dimensioning process

From a given orthographic views of an object, repeat asking yourself the following questions in a sequence.

Q1 : **What** feature is to be dimensioned?

Select the object feature and identify its type.

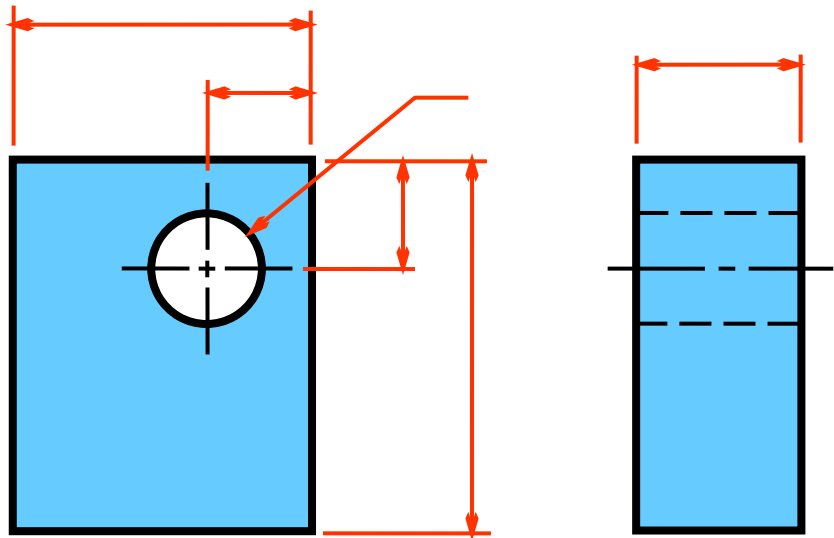
Q2 : **How** to present the dimension?

Matching the feature's information to an appropriate dimensioning components.

Q3 : **Where** to place the dimensioning components?

EXAMPLE

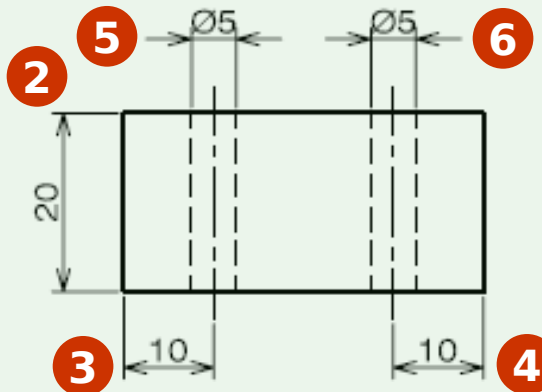
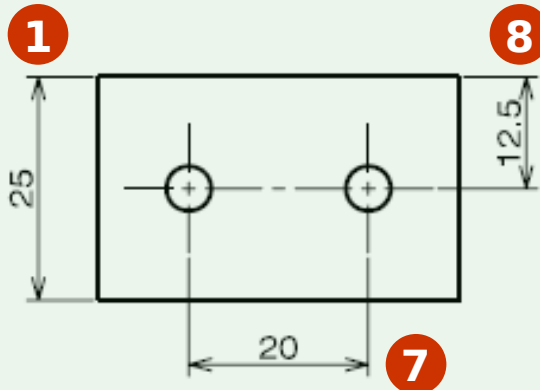
Given



What	How	Where
1. Height of the part	Extension and dimension lines, and dimension number	Front, right edge
2. Depth of the part	Same as 1.	Side view, top edge
3. Width of the part	Same as 1.	Front view, top edge
4. Diameter of the hole	Leader line and local note	Front view
5. Depth of the hole	Not necessary (through hole)	-
6. Position of the hole	Extension and dimension lines, and dimension number	Front view

...

Class exercise



Determine an appropriateness of the given dimensions.

Click on the button below to see the answer
(Also, try to think about the reason and how to give a better dimension.)

1

2

3

4

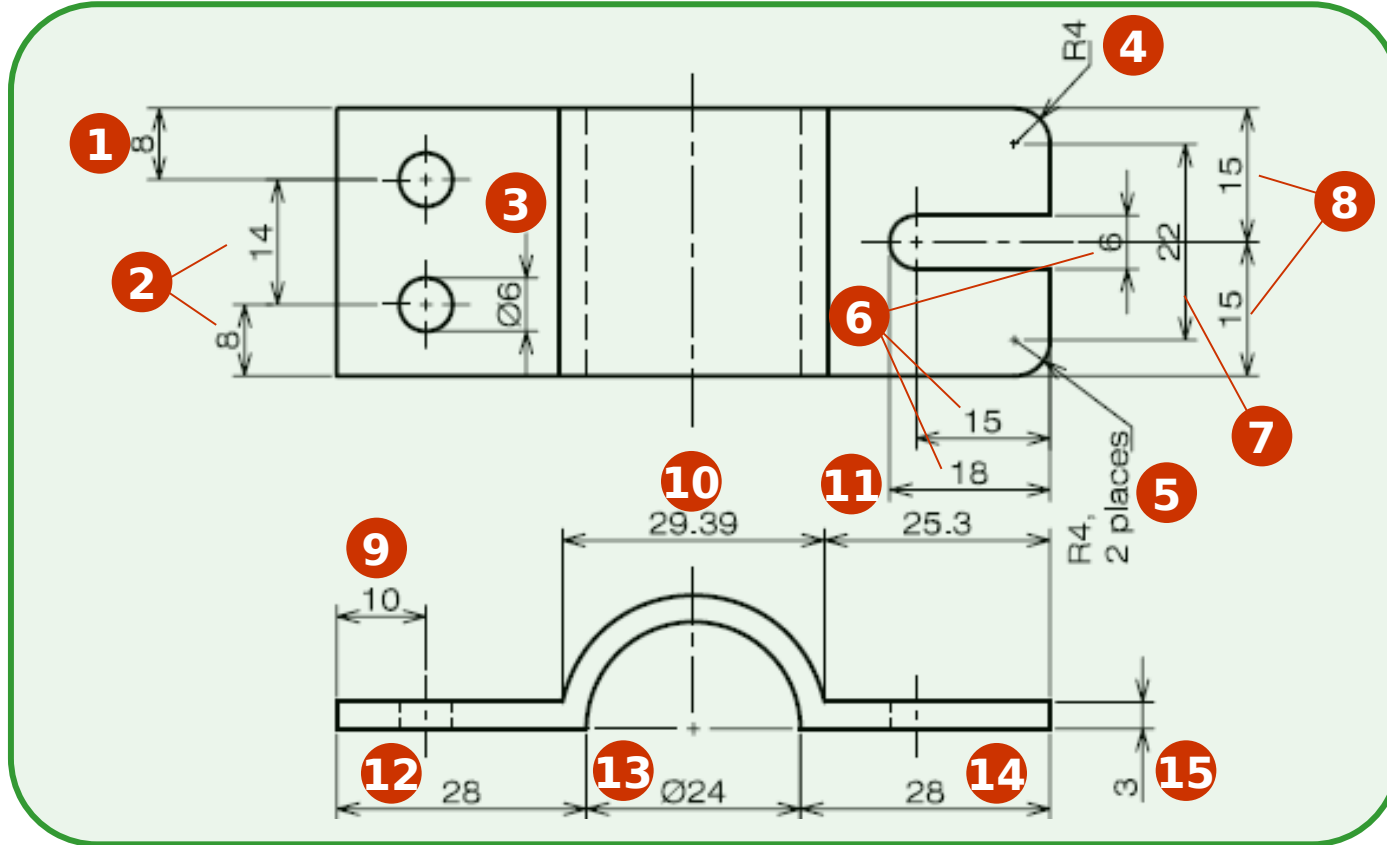
5

6

7

8

Class exercise



Determine an appropriateness of the given dimensions.

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15